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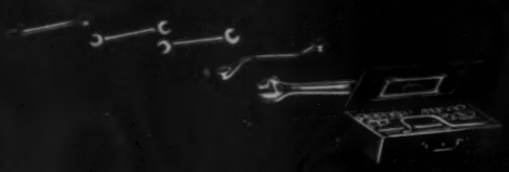
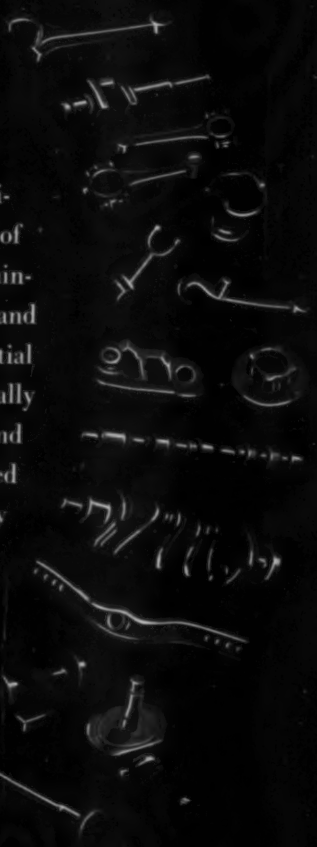
THE TECHNIQUE OF FORGING



. . . demands continuous research and the application of quality control. One of the most important requirements to ensure strong forgings with optimum machinability—at the rate of 75,000,000 per year—is the attainment of the correct grain flow and microstructure which are as essential as compliance with the generally specified chemical composition and physical properties. All materials used in Garrington's forgings are carefully examined in their new laboratories to ensure that these exacting requirements are fulfilled.



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Godfrey Type 15 Cabin Superchargers, now chosen for the Herald, have established a unique reputation for economy and reliability in the North Star, Argonaut, Ambassador and Viscount . . . total flying time to date in excess of 2½ million hours . . . life between overhauls approved for periods up to 3,500 hours. Overhaul, test and spares service is provided by associated companies of the Godfrey Group in Canada, Australia and South Africa.

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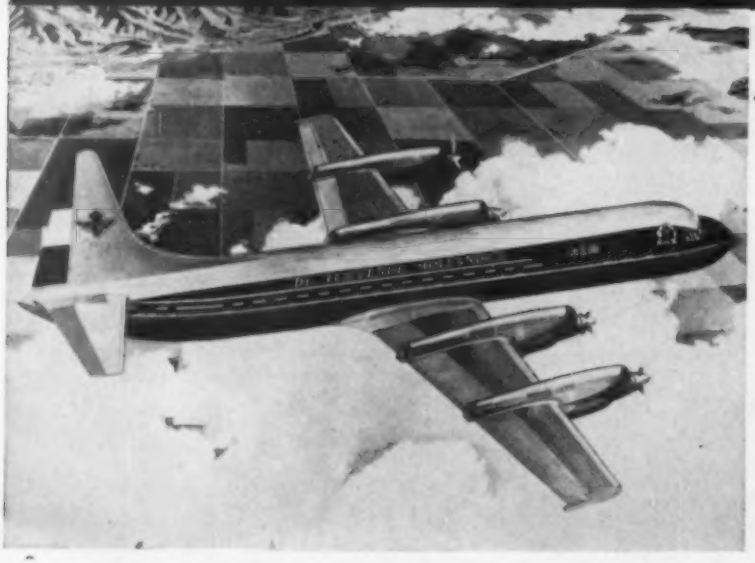
A

Around the World

FOURTEEN AIRLINES in 11 countries have ordered the newest Douglas transport, the DC-7C. All of the 117 aircraft now on order will be equipped with Hamilton Standard reversible Hydromatic propellers with aluminum alloy blades. Airlines which have placed these orders are Braniff International Airways, Northwest Orient Airlines, Pan American World Airways, British Overseas Airways Corporation, Alitalia, Cia. Mexicana de Aviacion, KLM Royal Dutch Airlines, Panair do Brasil, Sabena Belgian World Airlines, Scandinavian Airlines System, Swissair, Real-Aerovias Brasil, Japan Air Lines, and Compagnie de Transports Aeriens Intercontinentaux.

With a 5,000-mile range, the DC-7C can fly nonstop westbound across the Atlantic against prevailing winds, or across the Pacific. Record-making nonstop flights have already been made by Pan American World Airways from Miami to Paris, 4,800 miles in 13 hours, 55 minutes, and from Frankfurt to New York, 4,060 miles against headwinds in 13 hours, 15 minutes.



A NEW TYPE of Hamilton Standard propeller designed for turbine engine installations has been specified by KLM Royal Dutch Airlines for its 12 Lockheed *Electra* propeller-turbine transports. Featuring several important advances in design, the propellers are reversible Hydromatics with hollow aluminum blades. Simple hydromechanical controls improve coordination between engine and propeller, and give greater flexibility in ground operations. Another Hamilton Standard product, known as a "Synchrophaser," will be used to minimize propeller noise and vibration.

with United Aircraft

LARGE, TWIN-ENGINED HELICOPTER above, the Sikorsky S-56, can carry 26 passengers and baggage. The first delivery flight of a production model of this helicopter has been made to the U. S. Marine Corps, which designates this model helicopter the HR2S. Two Pratt & Whitney Aircraft Double Wasp engines similar to the 2,500 hp engine in over a thousand modern airliners power the huge helicopter, which has retractable landing gear. Its design, range, and payload reflect significant advances in helicopter design and production. Quantities are on order by both the U. S. Marine Corps and Army.

U. S. JET TRANSPORTS ORDERED BY 16 AIRLINES

Sixteen leading airlines around the world have ordered fleets of U. S. jet transports, either Boeing 707s or Douglas DC-8s. Both types will fly with JT3 or JT4 turbojet engines made by Pratt & Whitney Aircraft. They will enter service starting in 1959. The lines which have ordered the new transports include:

Pan American World Airways
United Air Lines
National Airlines
American Airlines
KLM Royal Dutch Airlines
Braniff International Airways
Eastern Air Lines
Continental Air Lines
Air France
Sabena Belgian World Airlines
Panagra
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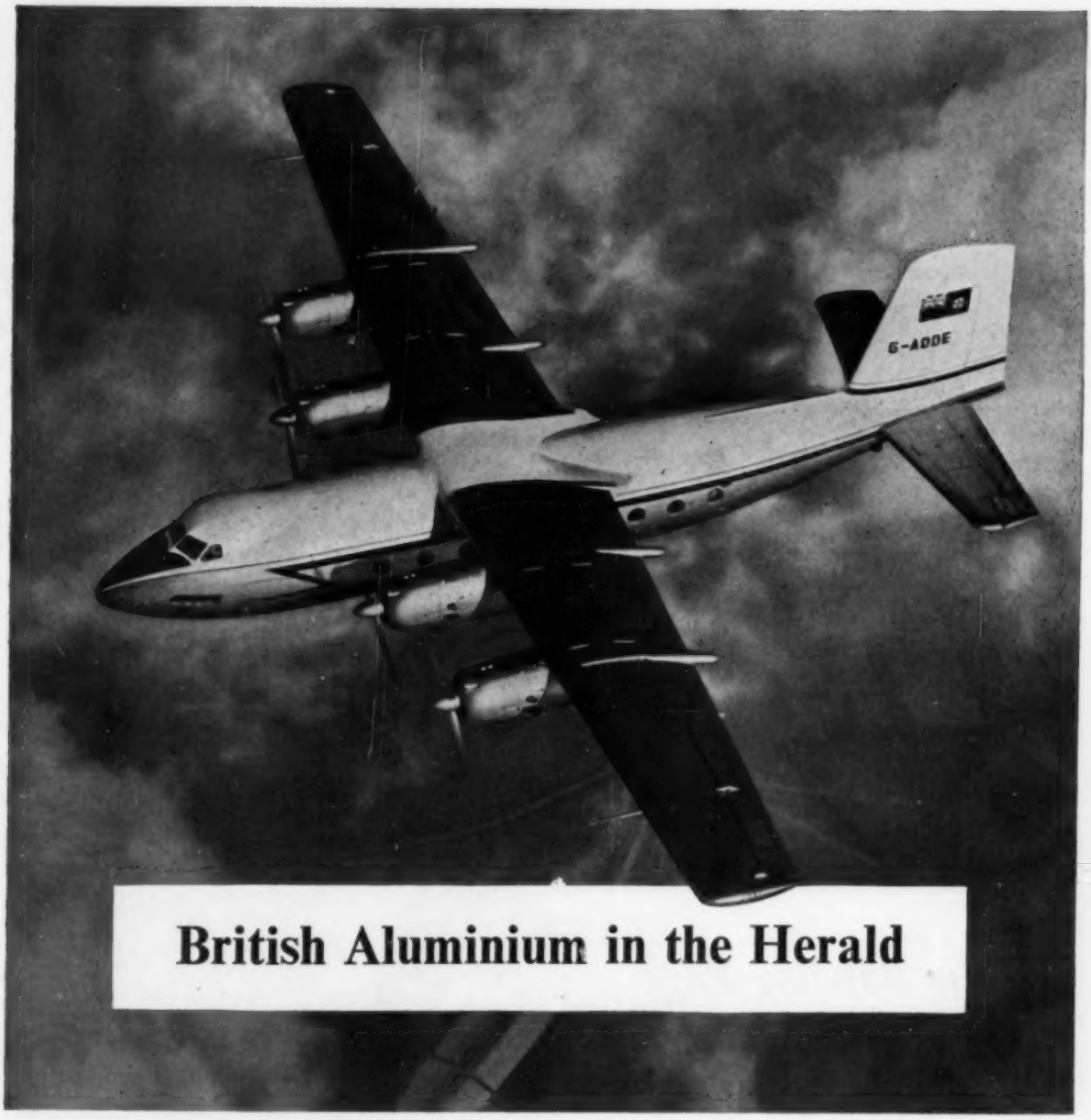

British Aluminium in the Herald

The Handley Page Herald, designed for arduous duty the world over, makes a major contribution to feeder airline services. British Aluminium sheet and strip have been supplied for use in the construction of this aircraft.

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For arduous duty the world over...

The Handley Page Herald is protected by Titanine Aircraft Finishes

This new Handley Page airliner and freighter, with its short take off and landing and its ease of servicing and dependability, is specially designed for operation on the workaday routes of the world. A versatile aircraft, the Herald carries 44 passengers, or nearly 5 tons of freight, or combinations of the two.

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"Almost every operating record has been smashed by the

VISCOUNT

—extract from "Capitaliner", magazine of Capital Airlines, Washington D.C.—

The following facts are taken from Capitals' first statement of Viscount operating costs. Period: July '55 - April '56, during which the fleet was built from 3 to 19 aircraft.

Break-even Passenger Load Factor

(All costs) 56.8%

Actual load factor 80%

The factor for costs directly related to the running of the aircraft was 25·5%. This was achieved with a utilization of 6·5 hours per day. Both direct and indirect costs at full utilization of 8·5 hours per day (already shown in May) should result in a break-even factor of 53%-55%.

With little over half the seats sold VISCOUNTS make a profit

Passenger load factors of 80% and over are being reported by most other airlines operating Viscounts. It is believed that these figures represent—

The highest sustained passenger load figures ever attained by an airliner

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VISCOUNT

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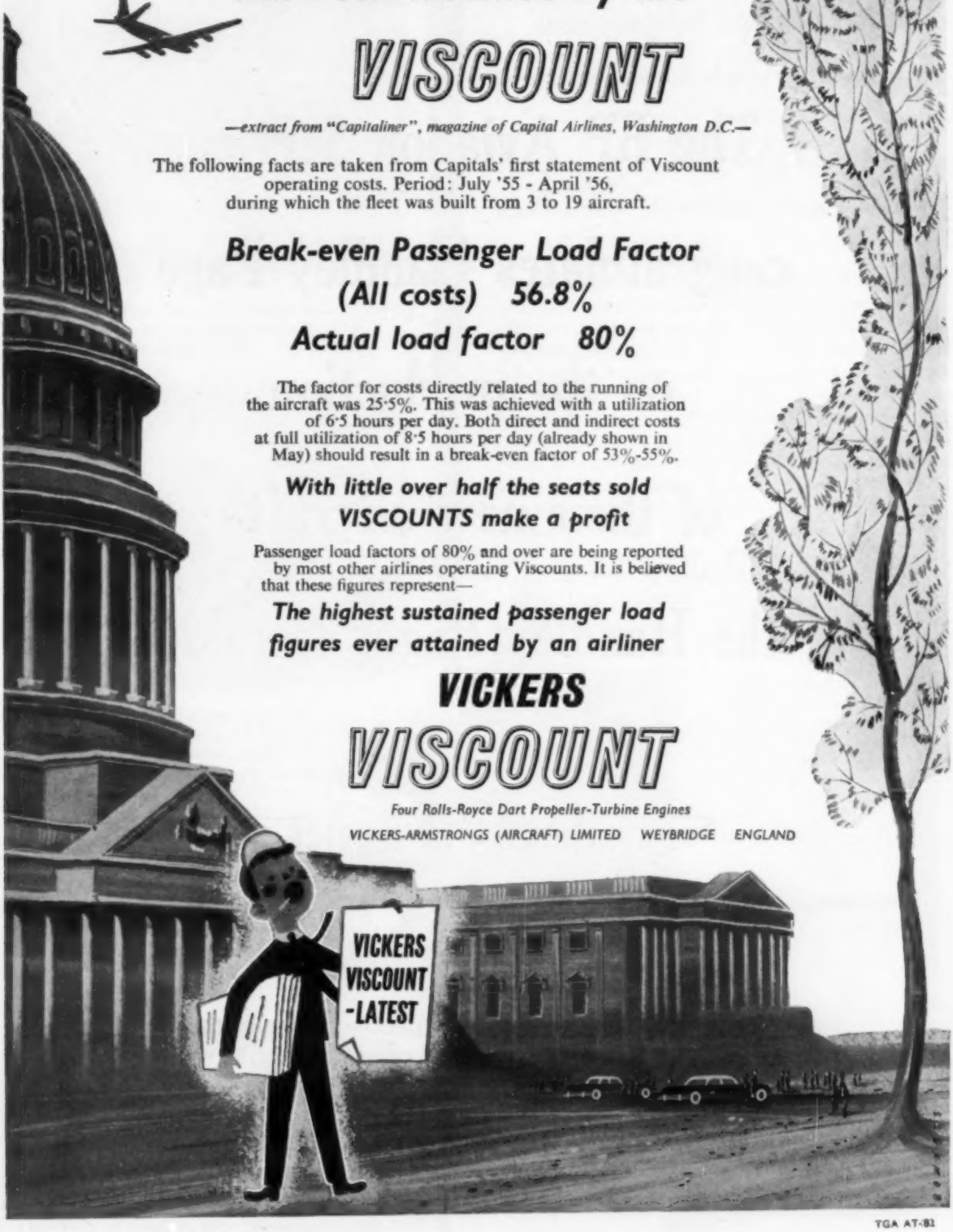
VICKERS-ARMSTRONGS (AIRCRAFT) LIMITED WEYBRIDGE ENGLAND



TGA AT-82

The BP Aviation Service congratulates Handley Page on the production of their new aircraft- the Handley Page 'Herald'

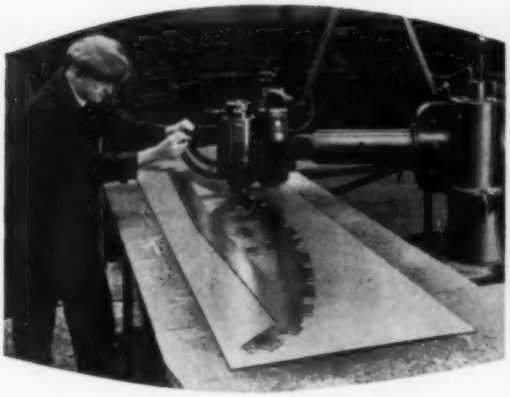
AVIATION BP SERVICE

SERVES AVIATION WELL

THE INTERNATIONAL AIRCRAFT FUELLING ORGANISATION
OF THE BRITISH PETROLEUM COMPANY LIMITED

New high speed machining techniques as developed by Wadkin

are to be used in the production of the *Herald* and other Handley Page Aircraft



One of the 10 Wadkin Routers LE installed by Handley Page Ltd., machining components used in the construction of the "Herald".

A Wadkin Heavy Duty Radial Arm Router, type LYR, with cutting speeds up to 18,000 r.p.m. is seen here milling components out of a solid forging of light alloy. Handley Page Ltd. have recently installed two of these heavy duty routers.

The necessity for high speed machining of non-ferrous metals, for prototype or production, is never more obvious than in the Aircraft Industry. That's why Handley Page Ltd. have installed more than 30 Wadkin machines—not conventional machines, but machines specially produced for working non-ferrous metals. Based on unique principles of design and incorporating new, high speed milling techniques, the latest Wadkin machines are the result of nearly 20 years specialised development in the machining of non-ferrous metals. Wadkin have taken full advantage of the fast cutting speeds and feeds that the aluminium alloys permit, and offer a complete range of machines that have already proved their bility to revolutionise production times on this material.

Three Wadkin Spar Milling Machines, type LZ8, as illustrated, have been installed by Handley Page Ltd. in the past year, and two more machines are on order.

Spar Miller Type LZ8

Wadkin

Wadkin Ltd., Green Lane Works, Leicester
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London Office: 62 Brook St., W.1. Telephone: Mayfair 7048

MISSILE WITH A MAN IN IT

Lockheed / U.S. Air Force F-104

World's Fastest Jet

The F-104 **Starfighter** is the most advanced airplane of its type ever developed. *Dimensions:* height 13 feet, 6 inches; length 54 feet, 9 inches. *Wings:* knife-sharp, and only 7½ feet from fuselage to wing-tip. *Engine:* General Electric J79, which develops more thrust per pound of engine weight than any other turbojet of comparable size. *Electronics system:* new "plug in" type, to permit quick changes and replacement of components. *Pilot's seat:* downward firing ejection type, the first in a production jet fighter. High, T-shaped "floating" tail; twice as effective in controllability as conventional tail designs. *Armament and top speed:* both are military secrets, but the Lockheed F-104 can overtake and destroy any plane—of any size—known today.

The **Starfighter's** dart-like configuration, perfected by extensive wind-tunnel tests, permits the F-104 to flash through the sonic-barrier, routinely, without a tremor. And even at supersonic speeds the **Starfighter** has unmatched ease and decisiveness of control—because never before have so many advanced design and engineering features been so superbly combined in one aircraft.

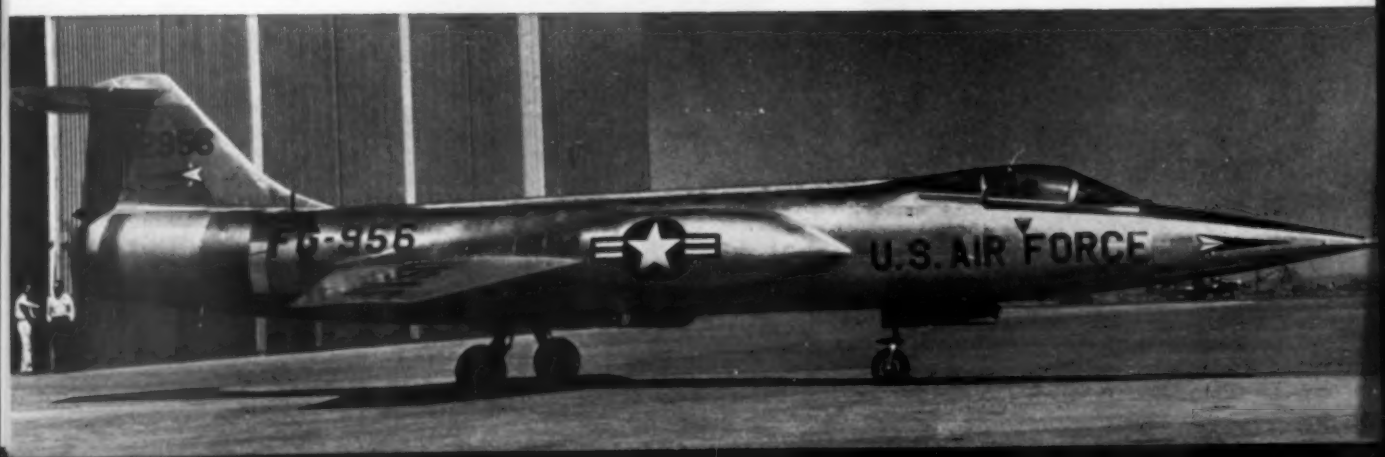
Like all Lockheed-built planes, the F-104 has inherent "design flexibility" that makes it readily adaptable to a variety of military requirements—at a substantially lower cost to the purchaser.

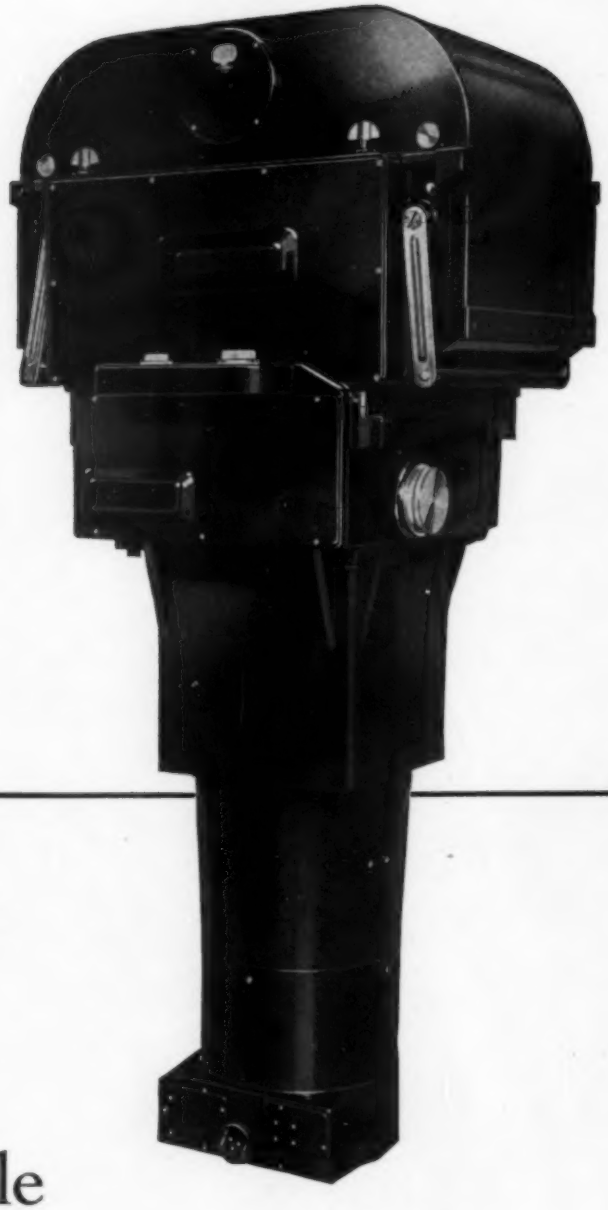
Lockheed's leadership in the design and production of military airplanes, of nine widely different types, is again demonstrated by the F-104 **Starfighter**—Lockheed's "Missile With A Man In It".

Lockheed

AIRCRAFT CORPORATION
BURBANK, CALIFORNIA, U.S.A.

Look to Lockheed for JET Leadership, Too





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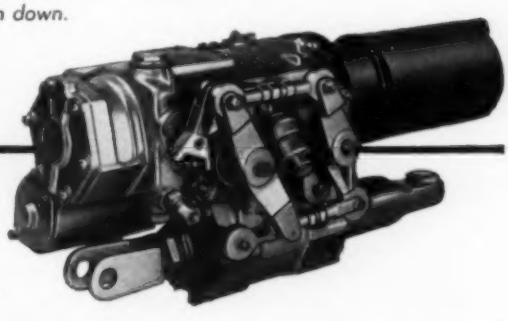

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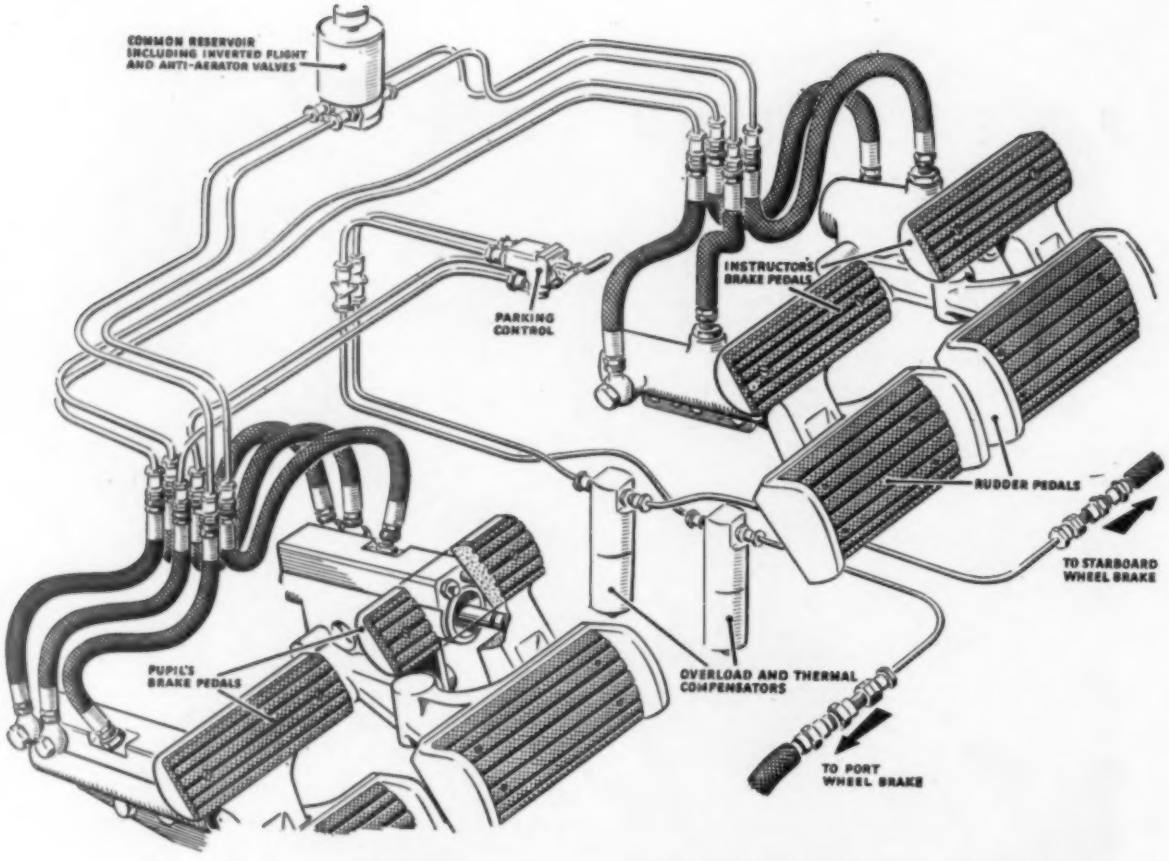

A SELF-CONTAINED TOE-OPERATED BRAKING SYSTEM

The Palmer hydraulic toe-operated brake control recently developed for dual operation on the Hunting Percival jet basic trainer is already showing its scope and versatility as a single control on other aircraft. Designed for use with disc brakes, the system is self-contained and is lighter, simpler and cheaper than a powered system — yet thoroughly reliable.

Among the special features of this low-pressure system are a pedal movement a third of that of other controls and also a parking control pressure compensated for a temperature rise or fall of 40°C while the aircraft is parked.

In the dual arrangement, while the brakes are normally operated by the pupil, the instructor can instantly take over by operating his pedals, which automatically isolates those of the pupil. Study of the illustration will indicate how the arrangement is 'halved' for installation as a single system.

* * * * *

Take advantage of Palmer leadership .... of Palmer design and engineering experience .... it has much to offer in the specialised field of aircraft braking and control systems.

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Taxes, submarines and Seamews

The submarine is now an even greater potential menace to Britain and other countries dependent on overseas supplies. This would be true whether nuclear weapons were used or not. Submarines might be the carriers of such weapons. In any event nuclear motors would greatly increase the range of submarines. Future anti-submarine operations would inevitably call for large numbers of search-and-strike aircraft, first, because coastal defence requires continuous air patrolling and, secondly, so that convoys, endangered at sea, could quickly put up an anti-submarine 'umbrella'—off improvised carriers—in any weather. In heavy weather, submarines, moving through relatively calm waters, have a mobility advantage over surface craft and are, therefore, a greater menace. Britain and N.A.T.O. countries, already heavily taxed to pay for the last war and anxious to guard against a possible next, are turning to weapons like the Short Seamew, designed for fully effective performance in action yet within a nation's capacity to build quickly, cheaply and in large numbers.

Young men—should they ever again be called up urgently as reserves to defend their country—could learn to fly and service the uncomplicated Seamew quickly. Their burdened elders will readily appreciate this Short answer to the problem of keeping down the cost of defence.

For modern anti-submarine operations—
the *Short* answer is the *Seamew*

Ready for service with the Royal Navy

Short Brothers & Harland Ltd., Queens Island, Belfast, N. Ireland
The first manufacturers of aircraft in the world; specialists in maritime aircraft since 1910

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for the **Herald**

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STR. 18-C
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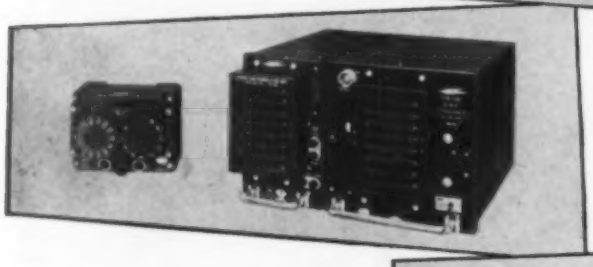
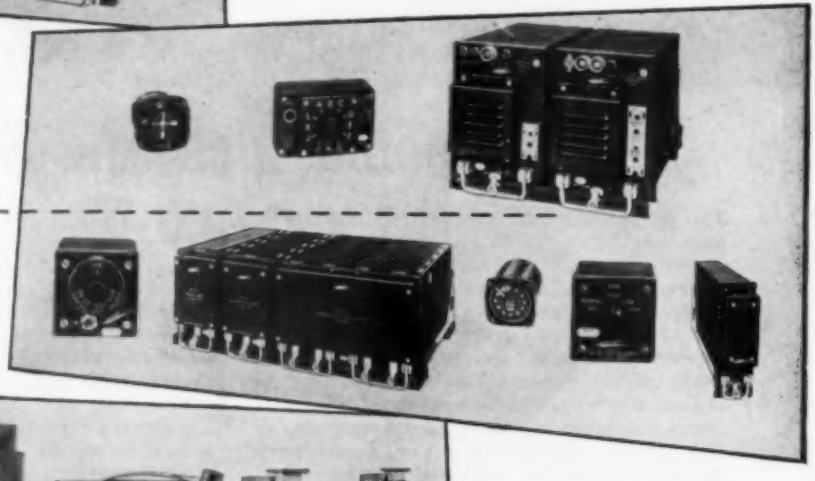


STR. 12-D
140-channel Pilot controlled V.H.F. equipment.



SR. 14-B/15-B
12-channel Instrument landing System receivers.

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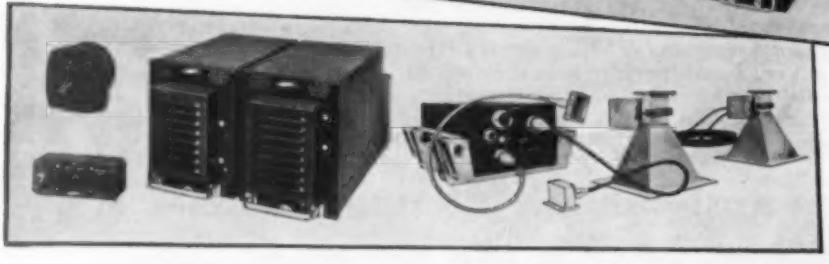
SR. 32/33.
100-channel combined I.L.S/VOR equipment



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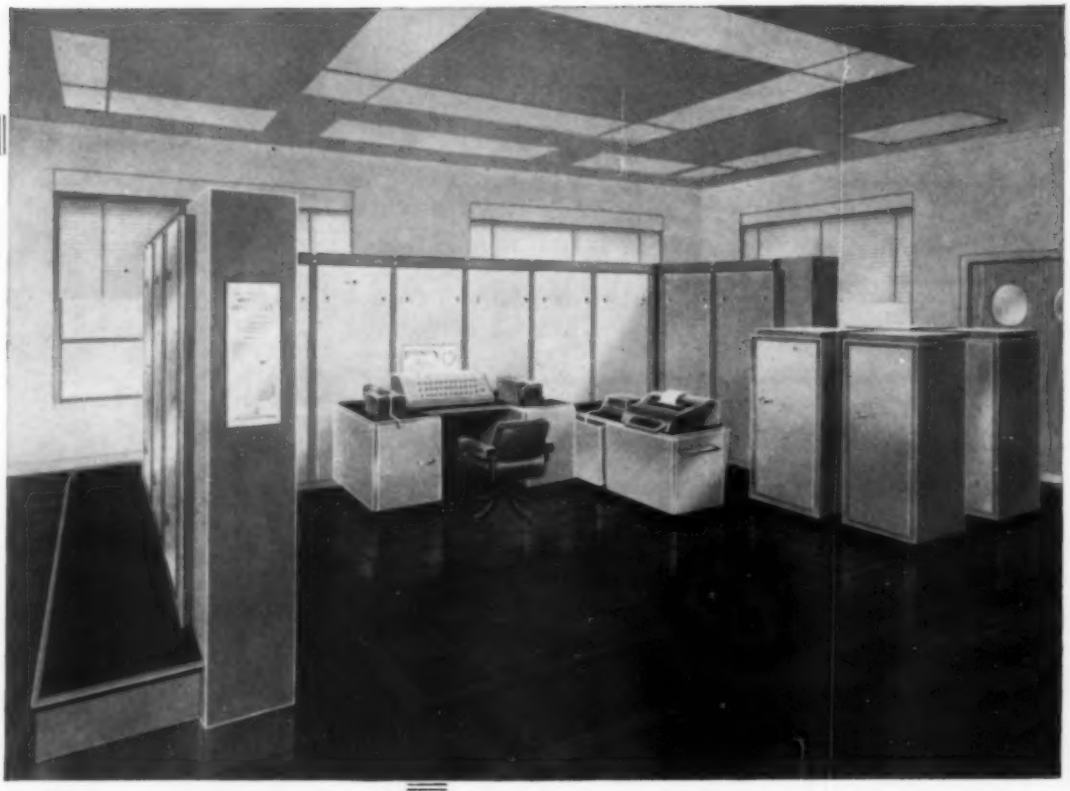

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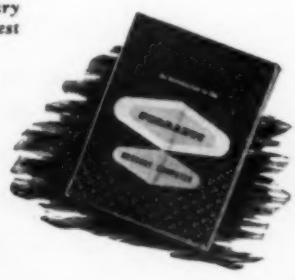

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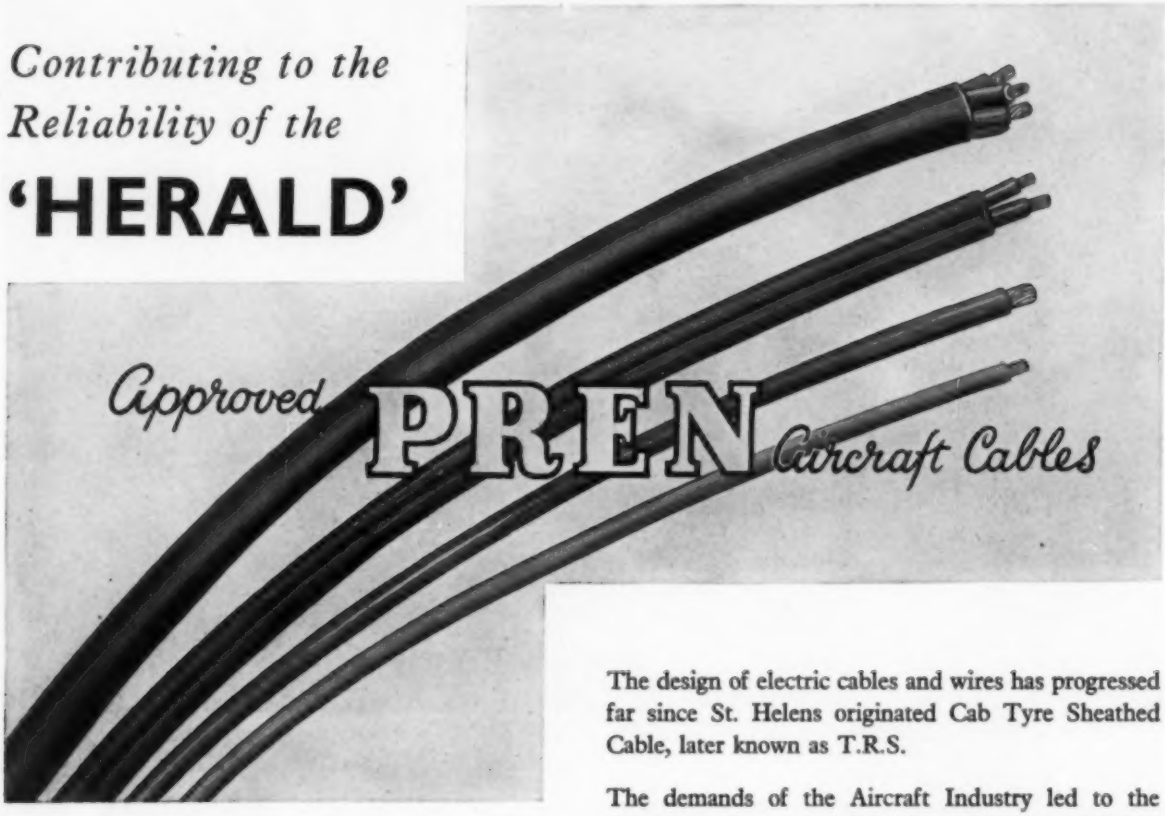

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The demands of the Aircraft Industry led to the development of a special range of cables—'PREN' Type—combining efficiency, light weight, fire safety and dependability. A descriptive brochure is available on application.

As suppliers of cables for the 'Herald', we congratulate the designers and constructors and are proud to be associated with this eminently successful aircraft.

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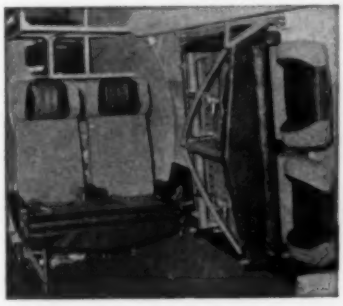
OR



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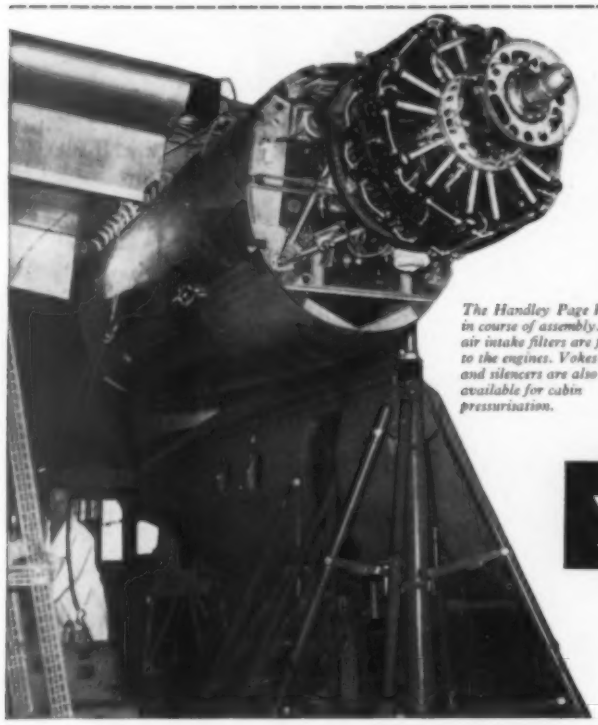

The Handley Page Herald in course of assembly. Vokes air intake filters are fitted to the engines. Vokes filters and silencers are also available for cabin pressurisation.

Reliability — efficiency — safety — economy — performance — all these qualities, and many more, have played their part in establishing the prestige of modern commercial flying. The new Handley Page Herald is designed to spread yet further afield the reputation of British aircraft. Pioneers of scientific filtration, Vokes have made vital contributions to the development of aviation and today they continue to ensure maximum protection and efficiency for aircraft throughout the world.

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V241

Herald

YET again Thermo-Plastics Limited have made a contribution towards the construction of a modern civil aircraft by producing for the Handley Page Herald, the nosecap from Glass-fibre and window assemblies moulded from "Perspex" in Glass-fibre frames, and components moulded from other plastic materials.

We are proud to be associated with this outstanding aircraft.

As the manufacturers of the largest and most complicated components for aircraft and many industries, we welcome enquiries from other manufacturers and industrialists.

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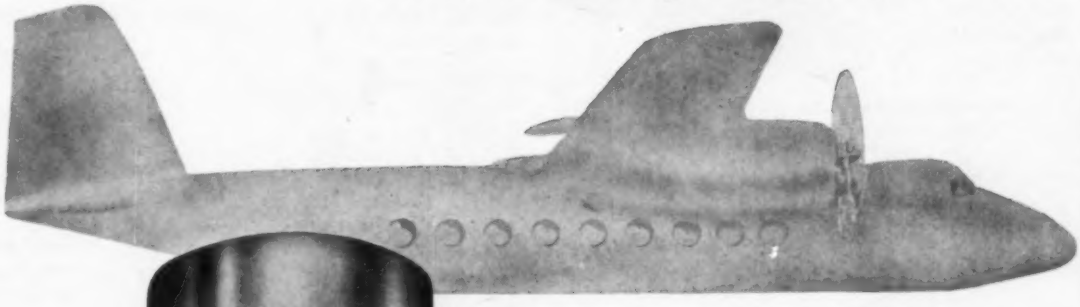

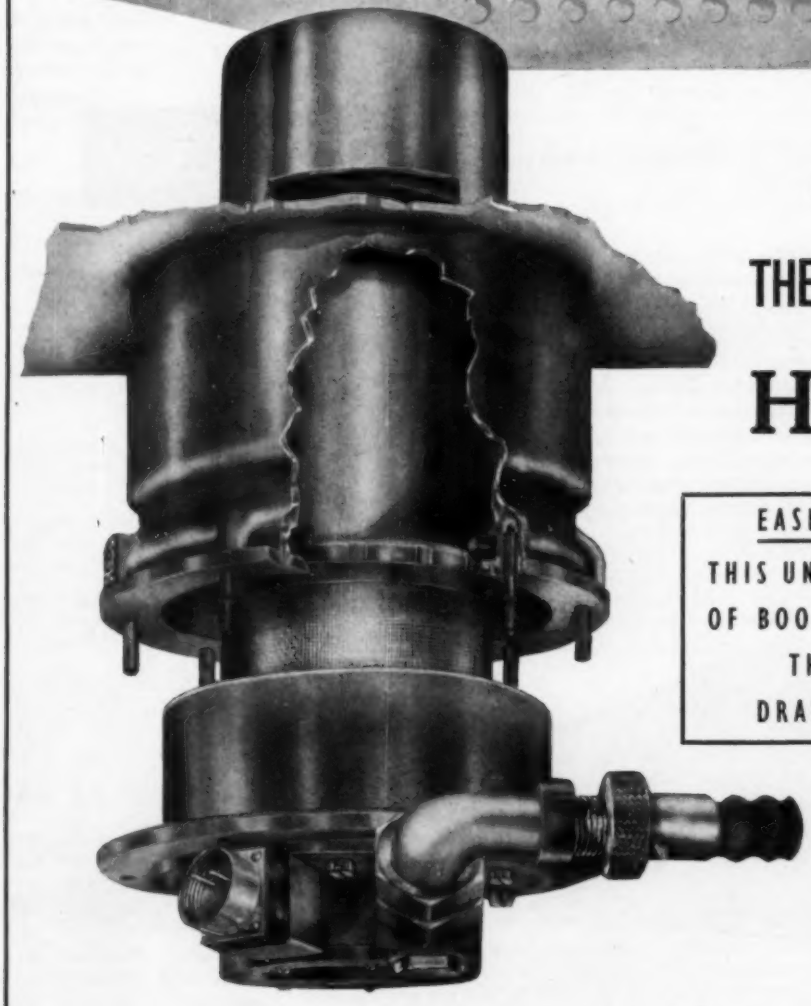

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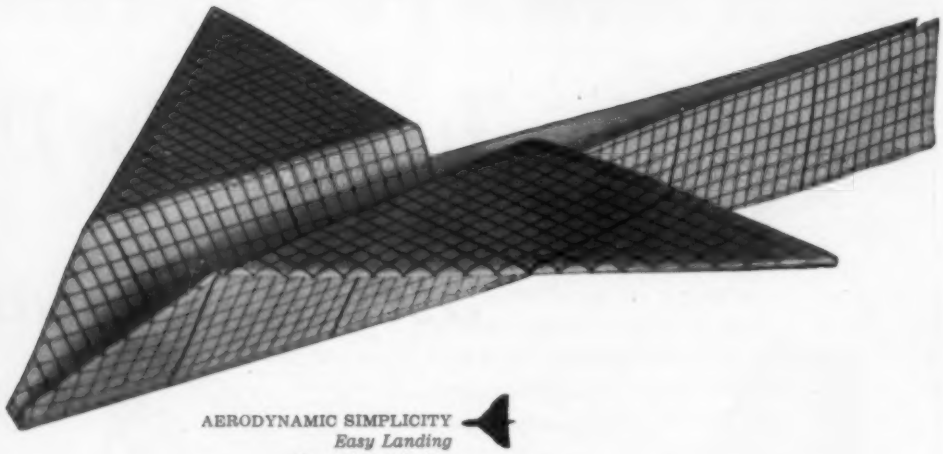

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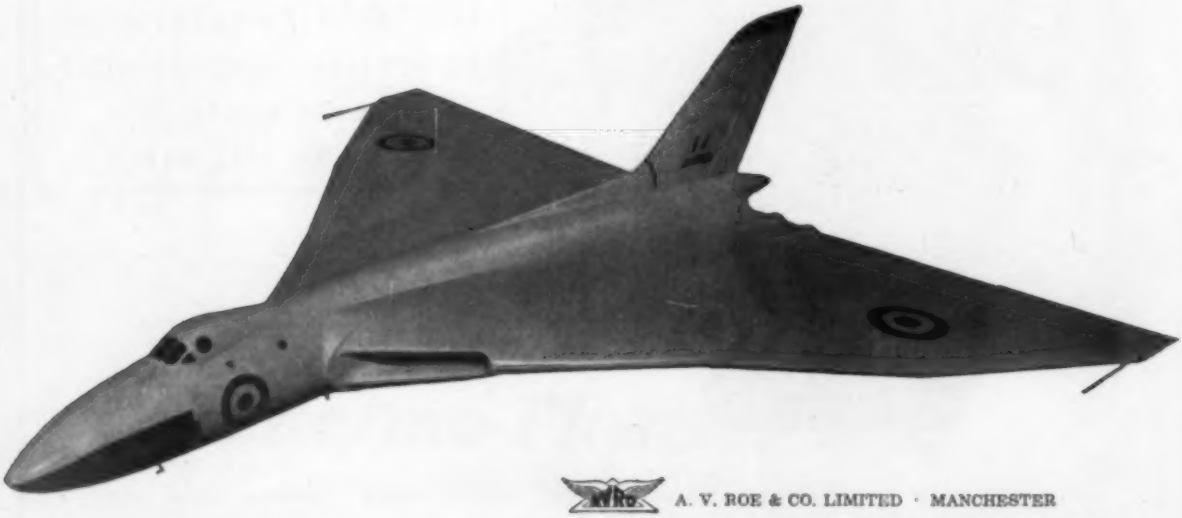

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FIRST AERONAUTICAL WEEKLY IN THE WORLD FOUNDED 1909

FLIGHT
and
AIRCRAFT ENGINEER

No 2479 Vol 70 FRIDAY 27 JULY 1956

Editor
MAURICE A. SMITH D.F.C. and BAR

Associate Editor
H. F. KING M.B.E.

Technical Editor
W. T. GUNSTON

Production Editor
ROY CASEY

Iliffe and Sons Ltd
Dorset House
Stamford Street
London, S.E.1
Telephone · Waterloo 3333 (60 lines)

BRANCH OFFICES

Coventry
8-10 Corporation Street
Telephone · Coventry 5210

Birmingham 2
King Edward House, New Street
Telephone · Midland 7191 (7 lines)

Manchester 3
260 Deansgate
Telephone · Blackfriars 4412 (3 lines)
Deansgate 3595 (2 lines)

Glasgow C.2
26B Renfield Street
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Capital Comets

CAPITAL AIRLINES, INC., of Washington, D.C., U.S.A., one of the world's busiest operators of medium-haul airliners, have placed an order for four Comet 4s and ten Comet 4As (as described in later pages) with the de Havilland Aircraft Co., Ltd., of Hatfield, Herts, England.

Seldom in the history of British commercial flying has there been such a welcome item of news, marking as it does a magnificent aeroplane's re-emergence from a shadowed period into the full limelight of world aviation.

The Comet story, it is fitting to remember, began with ambitious technical aims and an exceedingly high order of commercial enterprise; and it progressed with the successive introduction of incomparably fast and comfortable services across half the globe. Then, just when everything seemed to be going the Comet's way, came mishap, calamity and disaster. A universally admired upholder of our national commerce and prestige toppled and crumbled.

What followed is of such recent happening that we recall it only in tribute to the skill and resolution of those concerned—the Navy's grim search in the Mediterranean; the laborious Inquiry; the unremitting probing and testing at the R.A.E.; the completion and flying of the Comet 4; and that splendid reaffirmation of faith, the world tour of 1955. Through it all the Comet's staunch godmother-Corporation held firm with an order for twenty of the stronger, farther-ranging "New Comets."

Beyond that solitary B.O.A.C. order, however, no operators seemed willing to commit themselves. Doubt had been dispelled by demonstration, but the situation was greatly complicated by new technical developments. America's DC-8 and Boeing 707 projects began to assume the aspect of hard metal and hard cash, and for trunk-route service they promised ranges and speeds clearly beyond the Comet's attainment. Quickly the pure-jet creed spread into the medium-haul field. Air France led the way with the Caravelle, and T.W.A. and Delta followed with the larger, faster Golden Arrow. In Europe one operator after another looked afresh at his equipment. Doubt and bewilderment set in where there was formerly a general acceptance of the turboprop. Then came Capital's order—this from an airline with a happy record of Viscount experience already in the making, and one which had been paying court to the Britannia.

And so the Comet, clipped of wing and stretched of fuselage, takes its place in the very forefront of a new trend. That we record in this same issue the signing by B.E.A. of a twenty-million-pound contract for turboprop Vickers Vanguards is merely one indication that it and its kind will have to contest every inch of the road to eventual supremacy on the "shop-window" routes.

But come what may, we rejoice at a splendid turn in the de Havilland fortunes.

In One Long Lifetime

FORTY-SEVEN years ago—on July 25, 1909, seven months after this journal was founded—Louis Blériot made the first crossing of the English Channel by a heavier-than-air craft. Propelled by a three-cylinder engine developing an uncertain 25 h.p., his frail machine spluttered from cliff-top to cliff-top at 45 m.p.h., thereby bringing him the *Daily Mail* £1,000 prize and the acclaim of the world. Now the Channel is being flown at six or more times that speed almost every minute of the 24 hours: traversed with scarcely a thought by men, women and children; by infants in arms and great-grandmothers.

A 1909 Blériot monoplane, expertly restored and looked after, remains airworthy in this country today; and in Bedfordshire last week, watching it become valiantly airborne (as related on page 148) we fell to wondering how comparable, if at all, will be the progress of the next 47 years—progress which may happily be achieved without war's cruel spur. Who knows? Perhaps one of our proud Viscounts of today will be the prized and still airworthy curio of some aeronautical collection of 2003.

FROM ALL QUARTERS

Royal Visits to the R.A.F.

THE Queen and the Duke of Edinburgh visited R.A.F. Station Marham last Monday, July 23, and during their five-hour tour spent ten minutes in the special storage area, where they were shown an atomic bomb. Details of its manufacture, explosive power and release were given to them. Earlier the royal visitors had seen the Valiant simulator and inspected radar equipment, the principal features of which were explained to them by Mr. A. I. Llewellyn, chief research officer at Bomber Command H.Q., who said that neither the Russians nor the Americans could match our present radar capability.

The Queen presented a squadron standard to No. 207 Sqn. and the royal party watched a fly-past of 72 Canberras and 20 Valiants. During their visit, the Queen and the Duke were accompanied by the Secretary of State for Air, Mr. Nigel Birch; the Chief of the Air Staff, Air Chief Marshal Sir Dermot Boyle; and the A.O.C-in-C. Bomber Command, Air Marshal Sir Harry Broadhurst. The Queen and the Duke had travelled from London Airport in a Viking of the Queen's Flight.

Today (Friday, July 27) Princess Margaret is due to visit R.A.F. Station Horsham St. Faith, near Norwich. A fly-past of 48 aircraft from four Fighter Command wings is scheduled to take place, preceded by a display by No. 43 Sqn. Hunter aerobatic team.

Capital Order Comets

LAST Tuesday, July 24, the following historic statement was made jointly by de Havilland and Capital Airlines: "Mr. A. F. Burke, managing director of the de Havilland Aircraft Co., Ltd., Hatfield, England, and Mr. J. H. Carmichael, president of Capital Airlines Inc., Washington D.C., U.S.A., announce today that Capital Airlines have arranged to purchase 14 de Havilland Comet jet airliners (Rolls-Royce Avon engines) at a cost, including spare parts and related inventory, of $53m (about £19m). Deliveries are to commence late in 1958. Four Comet 4s will be supplied, to be followed in the second half of 1959 by ten 4As, the latter version being intended more particularly for medium-stage and short-stage operations."

Mr. Carmichael added: "The decision to purchase the Comet has been made after a most comprehensive and detailed study of all flight equipment either in production or projected, both in the United States and England. The economic and operating characteristics of the Comet 4A are ideally suited to the Capital system. The Comets will go into service on our major and most competitive routes." *Editorial comment: p. 137. Background to the Comet 4A: pages 167 and 168.*

CELEBRATION: As described in a news item opposite, the first Boeing KC-135A jet tanker was recently "rolled out" from the company's factory at Renton. It is seen here with the last of 888 piston-engined KC-97s, and approaching in salute are the 707 and a B-52.

R.C.A.F. Comet 1As' Future

THE R.C.A.F.'s two Comet 1As which have been in storage at the de Havilland Toronto establishment since April 1954 have been flown to Hatfield for pressure-cabin modifications. The second aircraft was due to be ferried back by John Cunningham last Tuesday. The cost of the modifications is estimated at £142,000.

Brough Milestone

ONE of the most significant landmarks in the development of the Blackburn integrated range of small gas turbines—based on the original designs of Turboméca—is the successful completion of a Ministry 150-hour type test on the Palouste. The Palouste is an air-compressor unit used in the Fairey Ultra-light helicopter, and also under development for various industrial applications.

M.o.S. Appointment

IT was announced last week that the Minister of Supply, with the agreement of the Secretary of State for Air, has appointed A. V-M. P. S. Blockey, C.B., C.B.E., B.A., to be Deputy Director-General of Aircraft Research and Development (R.A.F.) in succession to A.V-M. W. A. Opie, C.B., C.B.E.

A.V-M. Blockey, who is 51, joined the R.A.F. in 1924 and in 1938 commanded No. 80 Squadron in the Middle East. He went to the Directorate of Maintenance, Air Ministry, a year later, and in 1940 to the Ministry of Aircraft Production. Later in the war he served in India and the Far East, and in 1946 became C.O. of R.A.F. Cosford. He was promoted A.V-M. earlier this year.

English Electric's New Managing Director

THE English Electric Co., Ltd., announced recently that Sir George H. Nelson, chairman and managing director, has relinquished the position of managing director in order to devote the whole of his time to the duties of executive chairman. The Board has appointed his son, Mr. H. G. Nelson, deputy managing director, to succeed him as managing director.

Sir George H. Nelson, Bt., F.C.G.I., M.I.Mech.E., M.I.E.E., has been chairman of the company since 1933, and he celebrated his silver jubilee as managing director in October last year.

Mr. H. G. Nelson, M.Inst.C.E., M.I.Mech.E., M.I.E.E., the new managing director, was appointed deputy managing director in 1949. He is an Honours graduate in Mechanical Science at Cambridge and was an Exhibitioner of King's College. Subsequently he had 2½ years' experience in France, Germany and Switzerland before taking an executive position with English Electric. From 1942 to 1949 he was managing director of D. Napier and Son, Ltd., joining their Board, of which he is still a member, when English Electric acquired control. In 1943 he became a director of the latter company.

He was made a director of the Marconi companies in 1949, and was responsible for their re-organization upon their joining the English Electric Group. He has been responsible for the development of the Group's aviation work and many other major activities.

Skeeters for A.O.P.

IN a slightly involved statement last week, it was announced that "Skeeter helicopters are being ordered by the Ministry of Supply for the Air Observation Post squadrons provided by the R.A.F. for operation with the Army."

It is understood that the Skeeters, when they start to become available in approximately a year's time, will be integrated with existing fixed-wing A.O.P. flights and that the pilots will be Army officers trained by the R.A.F.—ultimately, if not at once, in Skeeters. This is a new departure for the Army and it is not yet decided whether all the pilots in a given flight will be qualified in both fixed-wing and rotary-wing machines or whether the two will be kept separate for flying purposes.

It is pointed out that while the Services have had experience of light helicopters, they have not previously had sufficient quantities to enable them to employ them as a piece of regular Service equipment. It is further remarked that small helicopters

***READY FOR WORK:** Recently given its C. of A., and finished in a new paint scheme of "Canterbury green" and "Dorchester grey," the Auster Agricola poses for its first air-to-air portrait. Note the pilot's excellent view over the sloping nose; the increased chord of the ailerons; and the deletion of the dorsal fin. The tailwheel has gleaned a bunch of grass from the airfield, which was being mowed.*

would be more easily concealed from enemy air observation than would fixed-wing machines and also that pilots conversant with the larger helicopters already used in the Service will be able to convert immediately to Skeeters, which have a similar control system.

For reasons unstated, Army, Ministry of Supply and Saunders-Roe representatives were unable to reveal the actual number of helicopters involved in the order, or their cost, or to give an indication of the cost of operating them as compared with that of light fixed-wing machines of the Auster type. The various answers given were that the order was "substantial," that it was the number the Army had asked for and, from Saunders-Roe, that it was sufficient to justify putting the machine into production.

There is no doubt that to have received official Service backing in this country will greatly enhance the prestige of the Skeeter and smooth its way towards sales abroad. Price and operating costs of a civil version have been given in round figures as £15,000, and £10 10s to £12 per hour, including insurance—but not, of course, crew pay.

In Army hands the Skeeter has undergone extensive trials, and it has been ordered on the strength of them. As a type of aircraft, it has been selected because the Army is now satisfied that there are certain jobs which must be done and which entail hovering flights. If this experiment proves successful, additional orders might well follow. It is foreseen that operations will be necessary in some areas where not even the very short trip required by the A.O.P. Auster could be prepared. The main uses to which the Skeeters will be put are: local observation duties in support of Army operations, personal transportation and training. All the machines will be equipped so that they can be adapted immediately for dual control.

Both the Skeeter and its engine have considerable development ahead of them. The machine itself, for example, is to have new, more efficient, all-metal rotor blades; and the de Havilland Gipsy Major 200 engine, which at present gives a top speed of 101 m.p.h., is likely eventually to produce up to 250 h.p. with the aid of its supercharging, new induction system and new cylinder heads.

A.W.A. Armaments Appointment

A FORMER senior executive at Woomera who joined Sir W. G. Armstrong Whitworth Aircraft, Ltd., a year ago, Mr. Charles Bayly, has been appointed chief engineer of the company's armaments division, which is responsible for the design, development, production and testing of rocket motors and missiles. Mr. Bayly, who is 40, was one of the original team sent out to Australia in February 1947 to set up the Long Range Weapons Establishment and Woomera Range. He served with the Ministry of Supply in Australia for four years, and was responsible for planning all range facilities of a technical nature: later he formed and ran the test vehicles group responsible for assembly, testing and flight trials of guided weapons. In 1951 he was appointed rocket motor design manager with I.C.I. at Summerfield Research Station, where he was responsible for the design, development and manufacture of rocket motors. Educated at Cheltenham College, Mr. Bayly learned to fly with A.S.T. in 1935, and served with Armstrong Whitworth as assistant to the production manager of Whitley 5 production before joining the R.A.F. in 1940. After Technical Branch service with squadrons he became O.C. Servicing Wing H.Q., Fighter Command. Immediately after the war he joined the M.o.S. and was engaged on the early design of monofuel and bifuel rocket motors.

Mr. Bayly

Tanker Roll-out

LAST week the Boeing Airplane Company held the "roll-out" ceremony, at Renton, Wash., for the first KC-135A tanker for the U.S.A.F. Strategic Air Command. Boeing gained the contract for 400 of these impressive aircraft in the autumn of 1954, and promised a first flight in September 1956—a programme which seems likely to be beaten. Receipt of these aircraft will revitalize the striking potential of S.A.C. by allowing the B-47s and B-52s to refuel at their operational speeds and altitudes.

The first machine (there is no prototype, the civil-*cum*-military 707 demonstrator having completed the basic testing) is officially designated KC-135A—BN-1, with the serial number 55-3118A (the "A" in the number is curious, in that it seems to imply that a similar aircraft with the same number has already been built —which is, of course, not the case). Powered by four Pratt and Whitney J57s with a wet rating of 13,500 lb apiece, the maximum weight is of the order of 270,000 lb. The seven wing-tanks have a total capacity of 17,398 U.S. gal, and the front and rear fuselage tanks house 4,500 and 6,380 U.S. gal respectively, making a total of 28,378 U.S. gal. Transfer is by means of a "Flying Boom" under the tail.

Coincident with the roll-out of the first "135" was that of the last of 888 KC-97 piston-engined tankers. The first 707 jet airliners are also due to leave the Renton factory in rather more than a year's time.

Death of Anzani

DESIGNER and builder of many early aero engines, including that which powered the monoplane in which Blériot flew the Channel 47 years ago, Alessandro Anzani died at Caen, in France, last Monday. He was 79.

First-time Sarah

THE "Sarah" air-sea rescue system—search and rescue and homing—proved its worth in thick fog on July 17 when the pilot of a Hunter was brought ashore less than 90 minutes after sending out a "May Day" distress call and baling out at 35,000ft. The pilot, F/O. N. R. Williams, was picked up by a Sycamore —from R.A.F. Station Thornaby, Yorks—which took off from there about ten minutes before he reached the water. Another Hunter provided a "fix" on the point where F/O. Williams had baled out, and when the helicopter was ten miles away from the dinghy its "Sarah" receiver began to pick up impulses from the transmitter F/O. Williams carried with him.

"Sarah" is a sub-miniature radio beacon weighing only 3 lb 8½ oz and, in spite of its small size, emits a signal that can be heard continuously for 20 hours over a radius of 70 miles. The user has only to pull a ring which releases a 31in flexible aerial and starts the transmitter. Sarah is produced by Ultra Electric.

The Air Racing Championship

ON the occasion of the National Air Race meeting at Baginton on Saturday last, F/L. H. B. Iles was declared British Air Racing Champion for 1956. Together with S/L. D. P. Boulnois and G. C. Marler, his points total in the championship was 56, the final top placings being decided by relative performances in the King's Cup Race. The championship table is given below, and the race meeting is reported on page 140.

Place	Pilot	Points per round 1st	2nd	3rd	Total points
1	H. B. Iles	18	16	22	56
2	D. P. Boulnois	18	16	22	56
3	G. C. Marler	18	18	20	56
4	D. F. Ogilvy	16	18	20	54
5	J. M. Donald	16	18	16	50
6	J. H. Denyer	8	20	20	48
	T. G. Knox	14	12	22	48
	A. Barker	18	10	20	48
9	A. S. K. Paine	14	10	22	46
	J. N. Somers	12	20	14	46
12	E. Crabtree	10	18	18	46
	C. Gregory	10	14	18	42
	A. G. Oldham	14	20	8	42
14	P. Blamire	10	14	16	40
	N. H. Jones	10	12	18	40
	J. R. Johnston	16	16	8	40

The above competed in the King's Cup Race. Also in the Championship list were: (17) F. Dunkerley and Miss A. Windle, 38; (19) B. J. Snook, 36; (20) J. E. G. Appleyard, 32; (21) R. H. McIntosh, 30; (22) P. S. Clifford, N. D. Norman and R. R. Paine, 28; (25) W. P. Bowles and P. Vanneck, 26; (27) B. Maile, 24; (28) J. G. Lovegrove, J. Rush, 20; (30) E. N. Husbands, 18; (31) A. J. Spiller, 12.

In the King's Cup race (above, left) Somers in Chipmunk G-AKDN kept ahead of Knox's black Proctor to finish fourth, gaining the Grosvenor Challenge Cup. The 1956 British Air Racing Champion is F/L. H. B. Iles (above, right) who flew a Miles M. 18/2. One of the best formation teams in Baginton's display was the Patrouille de France, whose Mystères are pictured (top right) during a slow pass.

"Flight" photographs

SENT TO COVENTRY

—for the Races, Aerobatics and a Flying Display: a Fête Shared by 20,000

A CRISP French aerobatic salad to delight the palate—even that of the stolid Midlander; a well-mixed and fruity King's Cup to follow; with Czech, Cornish and local dishes, not forgetting Naval sea-food, in rapid succession as required. Prepare liberal helpings under a 2,000ft overcast, serve but a few miles as the Stampe flies (which is upside down) from Lady Godiva's statue, and ignore the absence of four American hot-dogs blazing the sky over someone else's table. And you have the indigestion that comes only and annually after Coventry's National Air Race meeting.

Course practice by air race competitors and the preliminary round of the British Lockheed International Aerobatic Competition took place on Friday last, July 20. There was a stiffish breeze at Baginton as familiar racing aircraft crabbed in on the final leg, winged round the aerodrome pylon and were aimed towards the next turning point. Walking along the line-up of those who had already flown the course, one noticed the final polishing, the newly fitted canopy, an oil leak being traced, a racing number being painted on a club aircraft which was substituted at the last minute (Saturday's flying would make a change from Elstree circuits, anyway). And one heard about the non-starter which all had hoped to see. In short, one was breathing the Baginton atmosphere again.

It was with the aerobatic preliminaries, described later in this report, that Friday's flying concluded. Saturday was a grey day, with a low cloudbase and poor visibility—at least until mid-afternoon, when the sun managed to burn a few gaps in the strato-cumulus layer. For most of the aerobatic and display pilots, however, "bad-weather routines" remained in the book.

The morning racing comprised the third rounds of the class races for the S.B.A.C. Cup, Osram Cup, Kemsley Trophy and Goodyear Trophy. The top 16 pilots in the 1956 British Air Racing Championship then went forward to the King's Cup race.

Before an afternoon crowd of 20,000, Leon Biancotto flew brilliantly to win the Lockheed aerobatic trophy for the second successive year, with Blaha of Czechoslovakia a close second. Placings in the King's Cup race, won by J. H. Denyer in an Auster J.1N., decided also the 1956 British Air Racing Champion—F/L. H. B. Iles of the R.A.F. (Miles M.18/2). The following detailed account describes the racing, the aerobatic contest, and the general flying displays.

The Morning Racing. Race day dawned dull and overcast, with cloud down to about 1,000ft. Ironical cheers greeted the 9.30 a.m. met. briefing that by 9 o'clock clearance to "one- to three-eighths, rapidly lifting" was expected. The pilots' scepticism was unfortunately justified; in spite of sunlight sampled from fleeting reflections on wings and canopies during the afternoon, the expected improvement did not arrive until near the end of the day.

At 10.22 a.m., with eight minutes to go before the start of the first race for the S.B.A.C. Challenge cup, the two Turboméca Palas engines of Dunkerley's Sparrowjet started up, and by 10.25 all engines were turning. Colourful visitors from Sierra Leone arrived. The Somers-Kendall S.K.1, which had suffered an under-

carriage failure on its arrival on Thursday, was announced as a non-starter. Conversation dulled and seats filled rapidly. At 10.30 exactly, W/C. McIntosh, the most experienced pilot present, pushed open his throttle and lifted the Proctor 3, G-ALCK, off and into the air. Twenty-three seconds later he was followed by Crabtree's similar aircraft, and by Buster Paine's Proctor a further nine seconds later. Incident occurred almost at once—poor McIntosh, after passing correctly oustide the last scatter point, aimed too far aport into the haze, and passed some 600 yd inside the Bubbenhall pylon. The inevitable disqualification followed.

Last aircraft off, 4 min 48 sec after the leader, was the Percival Mew Gull flown by Peter Clifford; and as he surged forward Marler completed the first lap comfortably ahead of Rush, having gobbled up the five-second handicap between their Falcon Sixes somewhere before the Bretford turn. With all the aircraft in the air, the handicapping assumed a greater significance. Gaps began to close. There was plenty of interest at the aerodrome pylon—the Sparrowjet and Mew Gull were obviously going to be in close proximity, and at the start of the third lap, the lovely white Mew—epitome of the best pre-war racing design—overtook the exciting modern jet with a steep racing turn in full view of the spectators—a classic sight. Racing technique is too controversial a subject to be discussed here, but tight turns taken late and right over the pylon appeared on several occasions to give an advantage. Ron Paine seemed to subscribe to this idea, although (as with several others) his recovery was more gradual, probably owing to difficulties in sighting the Bubbenhall turning point; and in some instances additional course corrections had to be made.

Incredibly soon, eyes were being strained towards the distant upwind Bretford turn for the appearance of the first man on the last leg. McIntosh retained his lead all the way and, diving very low, was followed over the finishing line by the winner, Buster Paine, Marler's Falcon Six and Crabtree's Proctor, all at about eight-second intervals. Fourth place went to brother Paine's Hawk Speed Six; Rush, like McIntosh, had passed inside a pylon and was disqualified. The backmarkers closed up very fast on the last lap, but were just over-handicapped—the Mew Gull, however, had averaged 203 m.p.h.—fastest race speed of the day.

By the time the programme had been consulted again, and aircraft colours pencilled in (for the racing numbers were very hard to see) the Osram Cup race was ready to begin. Johnston and Somers had both collected 32 points towards the Air Racing Championship in the previous rounds of the race, and Barker and Knox were close behind.

First man off was Appleyard in the delightful Walter-Mikron-engined Chilton D.W.1a, who climbed fairly high. Blamire's Gemini was really pulled off the ground, Johnston (modified Hawk Trainer 3) seemed airborne almost too soon for his ailerons to bite, Barker kept his tail high and his Proctor low, and Somers' Chipmunk was particularly neat. Round the scatter points and on to the first leg, the diminutive Chilton seemed to be going very fast, smoke trailing behind as it disappeared towards Bubbenhall, to reappear briefly in a slightly climbing turn before diving down into the valley to start the upwind leg towards Wolston. Only 12 seconds covered the start of Johnston, Knox, Somers and Husbands (Proctor 3), and at the final scatter point Knox had passed Johnston and was closing on Blamire's gold Gemini.

At the end of the first lap Appleyard was still well in the lead, and the Chilton took the pylon in a fast, rather wild turn entailing a good deal of correction, followed by Knox, who had passed Blamire, with the rest streaming out behind. Crabtree in the Gipsy Gemini was still too far behind for his challenge to be assessed, but he was travelling some 13 m.p.h. faster than anyone else. Laps 2 and 3 were flown without any further position changes taking place, but the Chilton's lead became very slender. Somers made full use of the Chipmunk's good rolling characteristics to produce fast turns, and the Chilton continued to be a little unsteady. Crabtree swung the pretty blue and white Gemini very low and close on his last aerodrome turn, but it was now apparent that the handicapping would defeat him.

As the finishing Very light was fired, the Proctors of Knox and Barker rushed past the Chilton in a very close finish, while Blamire, Somers and Crabtree were satisfactorily close behind.

In the Kemsley Trophy race, Beverley Snook elected to fly Miss Mackellar's Tiger Moth instead of the Norman Jones machine, which had been withdrawn. This left a mixed field of three Tiger Moths, an Auster J1N, a Taylorcraft Plus D, Bowles' Monarch, and Messenger 2a—to be flown by Tomkins in place of Spiller, whose licence had lapsed.

S/L. Boulnois was first away, since he carried a passenger—a very streamlined lightweight passenger as it turned out—for the Bullnose Tiger rather cocked a Snook at Miss Mackellar's machine (which suffered a 58-second handicap for its modifications—noticeably no slats or strakes and a faired-in front cockpit).

[*Continued overleaf*

Left, Leon Biancotto, Lockheed Aerobatic Trophy winner, receives his prize from King Feisal: below, left, King's Cup winner Jim Denyer. Below, the line-up for the aerobatic contest; nearest are the Zlin Trener 6 (Blaha), Stampe SV4c (d'Huc Dressler), Stampe SR7b (Biancotto) and Morane 230 (Hisler).

"Flight" photographs

"Flight" photographs

Above (left to right), Geoffrey Marler, S.B.A.C Challenge Cup winner; S/L. D. P. Boulnois, Kemsley Challenge Trophy winner, and F/L. J. M. Earland (passenger); A. Barker and T. G. Knox, joint winners, Osram Cup, and J. E. G. Appleyard, third in Saturday's round of this race.

SENT TO COVENTRY . . .

It is interesting to see how the handicap time is influenced by take-off performance, and random checks showed that Tomkins (Messenger) and Denyer (Auster) maintained their 35-second interval round the scatter points, but Bowles had reduced his interval behind Tomkins by four seconds over the same distance. By the time the second turn of the aerodrome pylon had been made the field had closed up appreciably. The Miles Monarch, fastest aircraft in the race and set to overtake seven other competitors, stayed fairly high, while Donald had lost a little air to Boulnois.

The finish was tremendous. Barely clearing the hedge, a gaggle of Tiger Moths raced towards the line. Less conspicuous, but surely just in front, were two high-wing monoplanes—Denyer's fast Auster and Gregory's Plus D, while Tomkins hardly had room to thrust the Messenger through. The first five aircraft finished within six seconds of each other and the judges announced that Boulnois had just kept his lead, hotly followed by Denyer, Gregory, Donald and Tomkins. Although Snook's aircraft was four m.p.h. faster than the other Tiger Moths the finish was so close that he was unplaced.

Right on time once again, and before the excitement of the Kemsley Trophy had died, came the Goodyear Trophy Race. Elstree instructors David Ogilvy (Comper Swift) and Audrey Windle (flying a Magister in place of the Whitney Straight) were supported by F/L. Iles—who had rushed over from Germany to fly the Miles M-18/2—against five Tiger Moths, three of which were registered G-AOAA, G-AOAB, and G-AOAD. Every pilot in the race was over-handicapped, or thought he was, which betokened a close finish, although the cognoscenti were inclined to tip the deceptively fast M-18.

Quite the most exciting machine to watch is the Comper Swift, sharing as it does with all very small aircraft, a certain model-like quality. Approaching a pylon, the sharp application of aileron is easily visible—the Comper snaps over ninety degrees, turns on the elevators and then rolls out. The engine ignores all this—the geared airscrew turning quite slowly to the gentle beat of the Pobjoy.

During the first lap Norman Jones began to overhaul his 49-second handicap (and Maile in his other Tiger), so that approaching the first turn the Tiger Moths appeared to keep a well-spaced box formation. Quarter was not given at the pylon —all kept low, close-in and accurate, not daunted by the others' close proximity. Audrey Windle's flying was noticeable for the precision with which her turns were commenced and completed —full rate of roll sharply held when the correct angle of bank was reached. Could the Magister have got round the course faster if flown with more variation in height?

The Goodyear was real racing—the Tigers remained bunched, and the backmarkers could be seen closing up on the final Bubbenhall-Wolston leg—determination expressed in every turn. The Very was fired, and Iles crossed the line a clear winner. Behind him Ogilvy dived very low, pipping Norman Jones for second place with Audrey Windle, Des. Norman and Peter Vanneck close behind. Men like Iles and aircraft like M-18s noted for future reference, the handicappers can be said to have had a good day. The winner of each race had a good day, too—a cup, £100 and, in every case, qualification for the King's Cup.

The British Lockheed Aerobatic Competition. The general standard of flying in this year's contest for the British Lockheed Trophy was high—particularly, one must add, that of the foreign competitors. One aircraft was a new type, while the remaining machines covered a constructional period of some 27 years. The prospect of a 1929 Morane 230 competing with a Gloster Meteor was, to say the least, novel.

Friday's eliminating contest took place with a wind high enough to cause positioning problems for the pilots, who now numbered ten (the Argentine and Spanish entries and one French entry having been withdrawn). The three French pilots who last year won first, second and third prizes were here once again; there were four valiant Tigers flown by British pilots; a Czech newcomer in the shape of the Zlin Trener 6; and (in the Group 1 heavy category) the Gloster Meteor 7/8 and a Hunting Percival Provost. Points were to be awarded for accuracy, artistry and positioning, scope, pilotage, and originality.

The first competitor was J. Pothecary, flying the yellow Tiger Moth G-ANPL. Although fairly wide in scope and showing inventiveness, his manœuvres were positioned too far over the judges' stand. Next was J. Blaha in the Zlin Trener 6, OK-JEB, third prototype of this design and powered by a 160 h.p. Walter Minor 6/III. And here was the first of the day's really sparkling performances, abounding in outside loops and inverted flying and with a knife-edged precision which was especially noticeable in the checking of flick manœuvres.

"Flight" photographs

(Upper view) Aerobatic champion for the second year running, Leon Biancotto lands in the Stampe-et-Renard S.R. 7b Monitor 4, after compatriot Alain Hisler had shown there was still much life in the vintage Morane 230 (bottom photograph) from St. Yan.

The green-nosed Tiger of C. Nepean Bishop was next to perform, starting with a falling leaf and including his own "five-point loop." Alain Hisler in the vintage Morane 230 followed, gained height, and calmly rolled over to the inverted position to await the green Very signal. Into the allotted five minutes he packed no fewer than 18 separate evolutions, including an inverted spin, outside loops, figures of eight and superbly judged upward flick rolls.

The next pilot was J. W. Tomkins (Tiger Moth) who gave an interesting display of semi-aerobatics, including what might be termed some "rock-'n-roll" flying. The Stampe SV4c flown by F. d'Huc Dressler then showed once more the polished and precise aerobatic handling one has come to expect from graduate pilots of the St. Yan school. Outside turns, a 360 deg circuit punctuated by four flick rolls, and an "M" formed by two stall turns linked by an inverted swoop were but a few of his crisp figures. Unfortunately he infringed the minimum height (100 metres) rule, and so had to be excluded from the marking.

The performance of F. C. Fisher (Tiger Moth) was marred by poor positioning and by his not using all the available time. Leon Biancotto next took off in the orange Stampe-et-Renard S.R. 7b monoplane and gave, in the words of the judges, "a display which approached closely to perfection"—as, indeed, befitted the 1955 holder of the Trophy. His vertical eight, one-and-a-half flicks, stall turns from the inverted position, and slow-rolling circuit of the

(*Concluded on page 172*)

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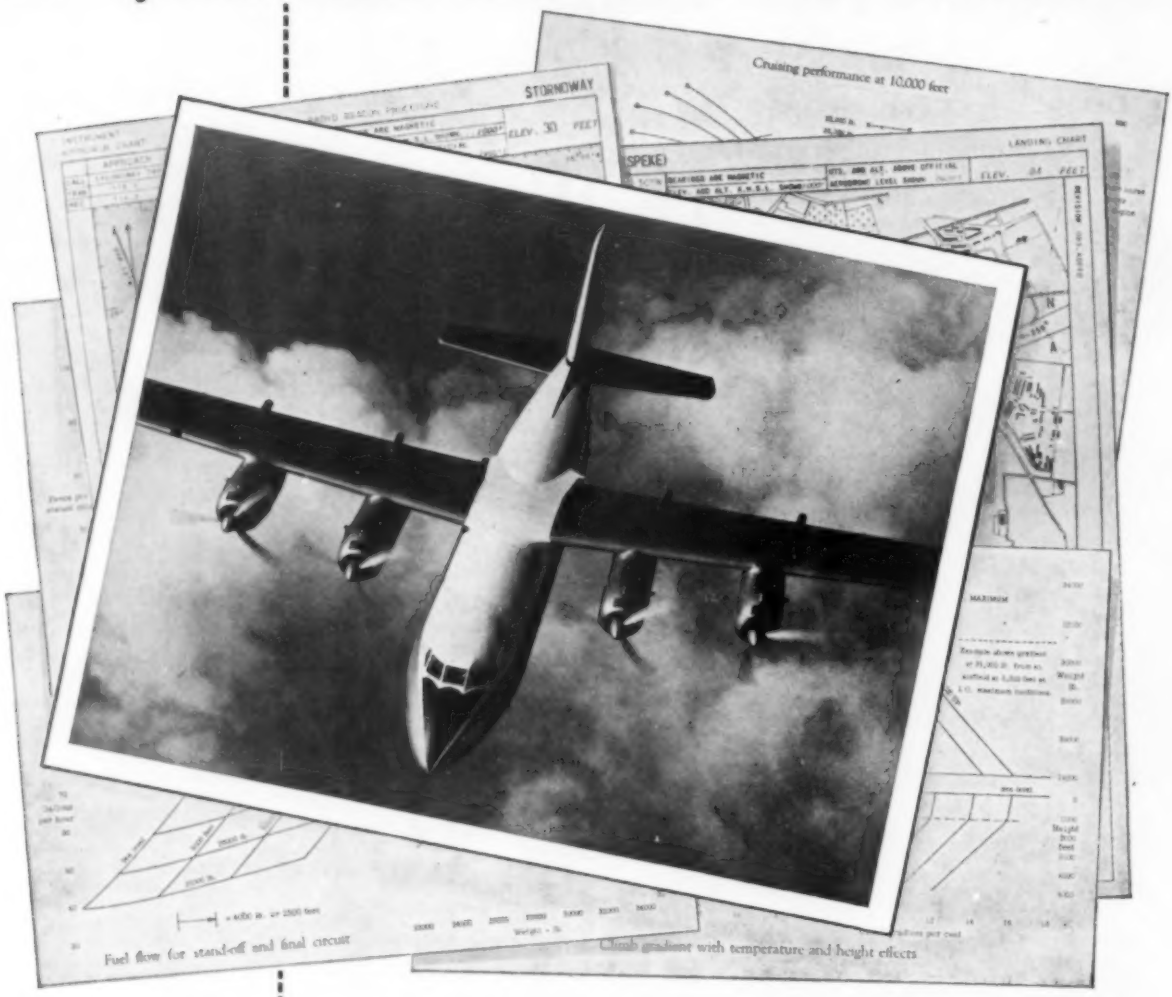
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A photograph taken from the cabin of VP-YND by Mr. George Edwards, managing director of Vickers-Armstrongs' Aircraft Division, during the Viscount's stay in Moscow. Beyond the spectators stand the S.O. 30 P Bretagne (which brought the French mission to Moscow) and the Tu-104.

Impressions of the C.A.A. Viscount's visit to Moscow's Airport

VISCOUNT TO VNUKOVO

THIS report, exclusive to "Flight," was written by G. R. ("Jock") Bryce and W. R. Peasley, respectively captain and one of the navigators of the Central African Airways Viscount which flew to Moscow shortly after the Soviet Aviation Day celebrations.

WHEN we reached London Airport we discovered that persons unknown, wearing some form of red paint, had come into abrupt contact with the port wing-tip of Central African Airways' Viscount VP-YND—causing slight damage which would not, however, have made the aircraft unserviceable. But we decided, in the interests of getting away on schedule (bearing in mind that Polish and Russian A.T.C. would be expecting us between 1100 and 1400 G.M.T.) to proceed with the damaged wing-tip.

After receiving a weather forecast which went only as far as longitude 13° 30' E, and getting Customs clearance at £2 sterling per head, the crew went out to the aircraft to find industrious B.E.A. engineers already engaged in changing the wing-tip. The interchangeability of components proved faultless and the aircraft was airborne at 0858, less than an hour behind schedule.

The flight to Berlin at 23,000ft was uneventful, except for one rather voluble (English) pilot informing the world at large and Berlin Control in particular that the Viscount was "way south" and over the Russian Zone. (At that time the Viscount's position was Brandenburg. Had someone forgotten the variation?)

On taxying to the ramp at Tempelhof we were greeted by the R.A.F. Liaison Officer and two Russian Air Force officers. They introduced us to the Aeroflot escort crew of navigator and wireless operator, who were to be our companions on the flight to Moscow and return. There was a certain amount of reserve at first, but eventually (although neither spoke the other's language) a spirit of good cheer prevailed.

Weather at Moscow was reported as poor, a cloud-base of 600ft and visibility of one mile in a quasi-stationary cold front. (Bryce comments that a close assessment of the weather on our arrival discerned cloud which was referred to as "chaotic" cloud—an unusual but satisfactory way of describing it.) Having reached this conclusion after calculation from kilometres, metres and millimetres, and when Valentin, the navigator, and Serge, the wireless operator (we couldn't establish their ranks), had rapidly mastered the essentials of our radio and navigation aids, we taxied out full of hope.

It was at this point we suffered our first setback. After waiting 30 minutes with engines running (due, it appeared, to Colonel Stromoff having said "Niet"), we returned to the ramp and after a further wait for 30 minutes were told that we couldn't proceed further because the Russian authorities would not give clearance, due to destination weather. We were later interested to learn from Mr. George Edwards, who was at Vnukovo, that the gloomy forecast was indeed correct, Moscow University being half shrouded by cloud (I.F. cloud base 150ft).

Deciding on an early take-off the following morning, we accordingly arranged to meet our escort crew at 0315 and with such a start in mind decided that early to bed would be wise. In passing we were interested to notice that a British passport would, in fact, take one past the East German Peoples' Police at the Brandenburger Tor into the Russian sector of Berlin.

The following morning was grey with drizzle and low cloud, but with a route forecast of fair weather cumulus and a good terminal forecast, we set sail with Valentin and Serge for Moscow.

Our clearance from Schonefeld told us to climb to 7,500ft over Tempelhof before setting course, climbing to 23,000ft on the route Furstenwalde - Lodz - Warsaw - Vil'nyus - Vitebsk - Moscow Vnukovo). Our expected flight time was 3 hr 40 min. We understood that separation of flights in Russia is referred to the datum of 1013.2 mb, i.e., aircraft fly at pressure altitude.

The frontal weather affecting Berlin was rapidly left behind and we soon reached cloudless conditions. It was most interesting to watch the Russian crew at work. Navigation was carried out by means of radio beacons, supplemented by map-reading. No log appeared to be kept, elapsed times being deduced from an interesting slide-rule. All *en route* clearances were obtained by W/T and, judging by the number of transmissions, we were being checked meticulously.

The radio operator was expert and took no time mastering the equipment. The navigator was interested to know at what differential pressure the cabin was kept and seemed more at his ease when we pointed out that although we were at 23,000ft the cabin altitude was below 5,000ft. (Bryce's note: A pity we mentioned this to Valentin, because it prompted him to produce Russian cigarettes. I regret to record that he was a chain-smoker.)

There was no difficulty in map-reading and the positions so found confirmed the forecast winds. An hour before reaching Moscow we were told to descend to 15,000ft and after 3 hr 38 min uneventful flying, we landed at Vnukovo at 0742 G.M.T. (1042 local time). The distance flown was 1,120 miles, the average ground speed 308 m.p.h.

On our arrival we found a huge crowd assembled to watch the departure of the Comet with the British delegation. The atmosphere was completely friendly. The space between the barriers and airport building was crammed with Russian sightseers watching with stolid interest the arrival and imminent departure. (Bryce's first impression of Vnukovo was of 500 solemn-faced Russians staring at our aircraft—but amongst them one beaming face, rather thin of hair on top—our managing director.)

When the Comet had taken off, the farewell party moved towards the Viscount and for the next 30 minutes we were busily answering questions (through an interpreter) relating to the electrical system, fuel consumption, windows and internal layout. Marshal Zhigarev and General Malinin were interested in the Dart 510 engines with which this aircraft is equipped. M. Tupolev, the "father of Russian aviation" was shown over the aircraft with his wife.

Eventually the Viscount was taxied away to its dispersal point between the DC-6 and the familiar Tu-104. This area was patrolled by Russian soldiers armed with automatic weapons; but, as we later discovered when walking round the Russian aircraft, they had no objection to our free movement on the dispersal.

We were taken by car to the city, past the new university (which we were told houses no fewer than 20,000 students), blocks of workers' flats, the Kremlin and over Moscow river to the Hotel

"Jock" Bryce (left) and Dave Glaser, snapped by George Edwards, smile cheerfully in the Moscow sunshine after flying VP-YND to Vnukovo.

VISCOUNT TO VNUKOVO . . .

Moscow. It is interesting to note that there is a marked lane on all the city streets which must be kept clear for State vehicles—a custom which is rigidly observed.

In the hotel we met two Russian interpreters who were also aeronautical engineers, and after a pleasant lunch walked from the hotel into Red Square, dominated on one side by the high red walls of the Kremlin and the imposing red granite of Lenin's tomb, and on the other by a huge department store. The rate of exchange (at 11 roubles to the pound sterling) gave no indication of the cost of living. By that standard a pair of shoes cost £60 and a quite ordinary dress £90. (Bryce comments: Have words with the commercial manager before our next visit to Moscow.)

On the way back to the airport, which we were due to leave at 18.00 hr local time, one of the interpreters, an aerodynamicist, took our party on a tour of the city pointing out the museums, the Bolshoi Theatre, the monuments to Pushkin and Gorki, the railway termini, power stations and the immense university building.

At the airport we found a large body of Russian aircraft industry officials inspecting the Viscount meticulously, a compliment which we returned by visiting the Tu-104 at the chief project engineer's invitation. (The strawberries and champagne given us as we entered the 104 set the standard for the rest of the aircraft.) The flight deck was roomy, comfortable (and efficient) and reminded us of the B-29, whilst the passenger cabin was sumptuously furnished and, in fact, had been used that afternoon for a farewell party to the British delegation.

Shortly after 1800 hr, again in company with the inseparable Valentin and Serge, we took off on the return flight to Berlin, where we landed at 2000 hr. We shook hands with our Russian escorts and exchanged gifts with them.

Our report must finish by thanking the Russian crew members who made the trip from Berlin to Moscow and back possible. Not only were they cheerful chaps but their work was of the highest efficiency. All members of the crew regretted that both of them could not be entertained in one of the local hostelries around Wisley.

CANADIAN FIGHTER STRENGTH INCREASE

AN increase in the R.C.A.F. CF-100 squadrons will bring the number on active duty with the regular force to 24, it was announced recently in Ottawa by Mr. Ralph Campney, Canadian Minister of Defence. The 12 other intercepter squadrons make up No. 1 Air Division in Europe with NATO. These use Sabres, but by the end of this year one Sabre squadron will be replaced with CF-100s and three more during 1957.

NEW LIGHTWEIGHT A.D.F.

THE new Type 21 A.D.F. equipment produced by Aircraft Radio Corporation of Boonton, New Jersey, is now going into production after a year of extensive flight testing and proving under the American MIL-E-5400 and C.A.A. type specifications. The A.R.C. Type 21 is a three-band superheterodyne receiver complete with power unit, receiver, control unit, indicator, loop, loop housing and all connectors. Weighing only 19.1 lb installed, the Type 21 is intended for use in all types of aircraft, but should be particularly handy for light aircraft.

The frequency ranges are 190-400 Kc/s, 400-840 Kc/s and 840-1, 750 Kc/s. The input power is 2.8 amps at 27.5 volts D.C. or 5.6 amps at 13.7 volts D.C.; all H.T. and A.C. is generated by the dynamotor, whose power requirements are included in these figures. The intermediate frequency is 142.5 Kc/s. The loop used with the Type 21 equipment is hermetically sealed and connectors are of the glass/metal seal type. In the mechanical design it has been presumed that the loop will not be shock-proofed, that it will be subject to maximum temperature change and that the cut-out in the airframe skin should be as small as possible. In fact, this measures no more than $6\frac{1}{16}$in × $3\frac{1}{2}$in. The streamlined loop housing, weighing $\frac{1}{2}$ lb, projects only 2in beyond the aircraft skin and contains an anti-precipitation-static material. To compensate for distortion of the magnetic field arising from its location on the airframe, the loop has a total of 14 error-correcting screws allowing corrections of up to 25 deg.

The new A.D.F. equipment uses 14 sub-miniature vacuum tubes with a conservative dissipation rating, so that sensitivity and selectivity are comparable to those of equipment used in larger civil and military aircraft. Particular emphasis has been placed on reliability, serviceability, low power consumption, and stability under adverse environmental and power-supply conditions. The Type 21 can be used as primary navigation equipment in light aircraft or it can be combined with V.O.R. and a lightweight V.H.F. communications radio to provide combined L.F. and V.H.F. navigation and communication service. It can, of course, also be used as a supplementary system in large aircraft where severe weight limitations apply.

SELF-CORRECTING AUTO-NAVIGATOR

UNDER the above designation, conveniently abbreviated to S.C.A.N., Lear, Inc., of Santa Monica, California, have developed aircraft navigation equipment based upon a computing system which is the subject of patents applications. The method is one of discriminating automatically between data from any two information sources by continuous electronic application of the laws of probability and error distribution. From the two sets of data, each having known chances of error, it deduces intelligence more accurate than either source could provide.

With S.C.A.N. equipment it is claimed that an aircraft will be able to fly straight to its target over enemy territory despite any attempt at electronic jamming and without disclosing its presence by emitting any radiation. The computor will make use of V.H.F. signals received from far beyond line-of-sight distances and will be able to discern inaccuracies caused by distance.

A S.C.A.N. installation might use the aircraft's heading and airspeed indications coupled with continuous directional reception from two V.H.F. stations. During the early part of a flight, errors inherent in the instruments would accumulate in the form of an erroneous position indication and S.C.A.N. would correct these data to conform with the radio information. Later during the flight, radio disturbances would affect the accuracy of the radio information; S.C.A.N. would screen this information, accepting only those signals which conformed to a reasonable estimate of the flight's progress. S.C.A.N. establishes automatically the circle of position uncertainty which would normally apply after a given airborne time and accept position-indication signals only insofar as they were plausible. A doubtful signal would have to be repeated several times before the computor would accept it, while those nearer a predicted position would be accepted more quickly. After an interruption of signals S.C.A.N. will plot the new position according to the most plausible and persistent signals.

in the Handley-Page

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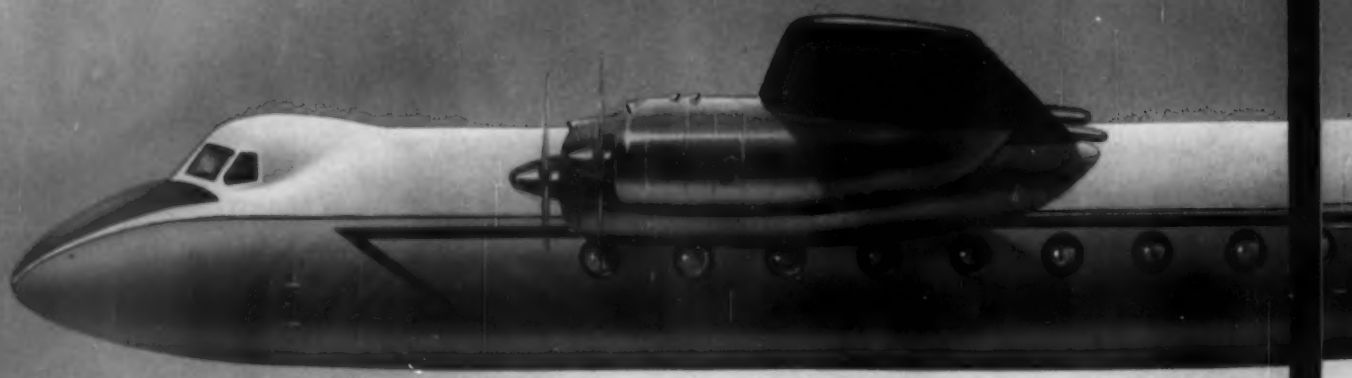

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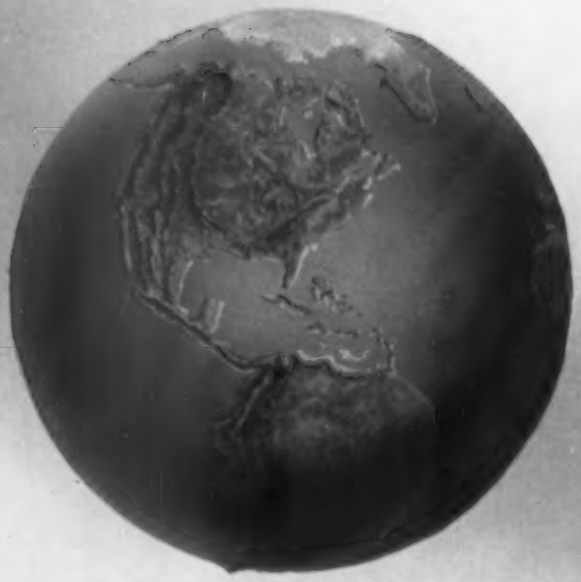

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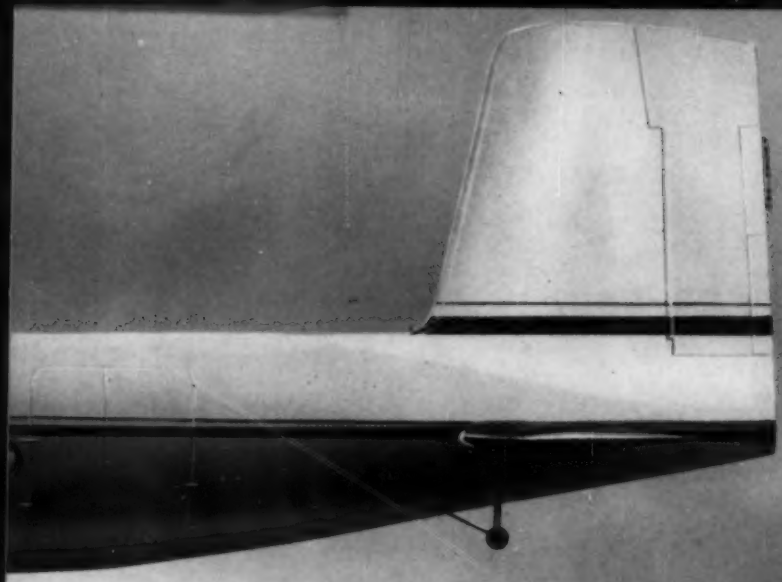

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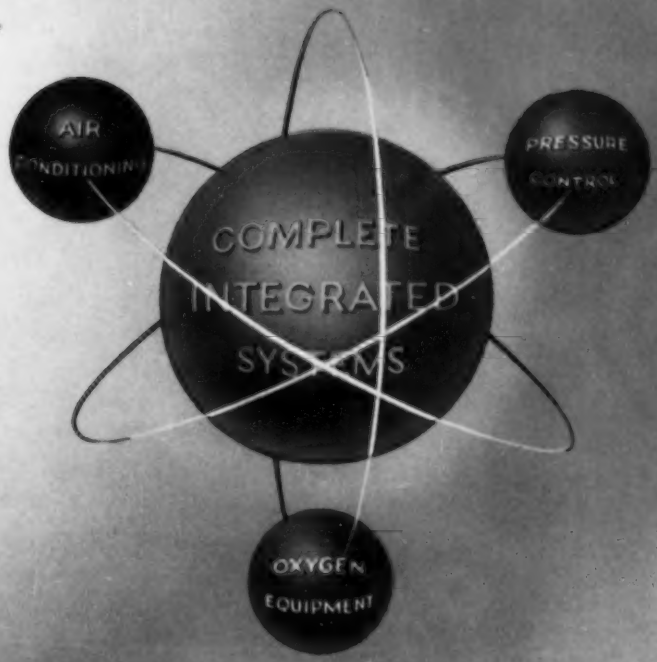

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HERE AND THERE

ONE OF THE FORTY-EIGHT: Lt-Cdr. Bradley making one of his engine-off on-the-water alightings at Calshot (see "Sea-Legs for Whirlwind," below) during trials to obtain A.R.B. clearance for amphibious operation.

Javelins for 29 Squadron

ADDRESSING members of No. 29 Squadron on the occasion of presenting their Standard at Tangmere on July 18, Air Chief Marshal Sir Dermot Boyle, Chief of the Air Staff, said that the squadron's Meteor night fighters would shortly be replaced by Javelins.

Helicopter Appointment

IT is announced that Mr. Andrew McClements, A.R.T.C., M.I.Mech.E., until recently senior principal scientific officer at the Ministry of Supply and formerly chief engineer of B.E.A.'s helicopter unit, has been appointed helicopter development manager of Bristol Aircraft, Ltd. Mr. McClements, who is 43, will be responsible for all development work at the company's Weston factory.

Ultra-Lear Agreement

ONE of the biggest American manufacturers of aircraft equipment, Lear, Inc., recently announced that it had concluded a ten-year licence agreement with Ultra Electric, Ltd., London. This will give Lear exclusive rights to make and sell in the U.S. the gas turbine control equipment developed by Ultra. The agreement includes a ten-year renewal option.

Sea-Legs for Whirlwind

THE assistant chief test pilot of Westland Aircraft, Ltd., Lt-Cdr. Roy Bradley, R.N.R., recently made 48 engine-off alightings on the sea at Calshot, Southampton, in a Mk. 2 Whirlwind G-AOCZ, fitted with inflatable pontoon gear. These tests, observed by A.R.B. officials, were carried out to demonstrate the machine's performance in the air and stability on the water and in order to gain clearance for civil operation with pontoons. The normal undercarriage had been replaced by a tubular structure which spreads the pontoons widely. During the sea-trials the engine was cut at altitudes varying from 400ft to 60ft.

Classic Car Race

THE next two issues (today's and August 3) of our associated journal *The Autocar* will be special numbers covering the Le Mans race, which is being held this week-end.

Compact Victory

THE so-called "powder puff air derby," an all-women event held annually in the United States, has been won by Mrs. Frances Bera, a flying instructor from Los Angeles. Mrs. Bera, who was competing in a Beechcraft Bonanza, won the race last year and in 1953.

Over To You

THE Polish Ambassador in Washington, Mr. Romuald Spaskowski, recently lodged an oral protest with the U.S. State Department, alleging that U.S. aircraft had violated Polish air space. This followed similar charges by the Soviet Union that American machines had penetrated almost 200 miles over Russian territory in the Grodno region and stayed for more than 90 minutes. In an account of the meeting between the Polish Ambassador and the U.S. Deputy Under-Secretary of State, Mr. Robert Murphy, it was stated that Mr. Spaskowski claimed the U.S. aircraft were "jets flying at high altitude." The State Department has since issued an official denial that U.S. aircraft have flown over Soviet territories.

IN THE ARMY NOW: A Saunders-Roe Skeeter Mk 6 in a highly appropriate setting—having regard to the news given on an earlier page concerning this useful little machine.

Military Aircraft Reviewed

A SPLENDIDLY illustrated reference work, *Military Aircraft of the World*, by the Associate Editor of *Flight*, is to be published by Iliffe and Sons, Ltd., on Tuesday next, July 31. A 60-page reprint from *Flight* for June 8 forms the bulk of the booklet, and is accompanied by an eight-page art supplement in which modern Service aircraft are seen in settings which are picturesque and in some cases highly dramatic. The price of the publication is 3s 6d net (postage 6d).

Cyprus Helicopter

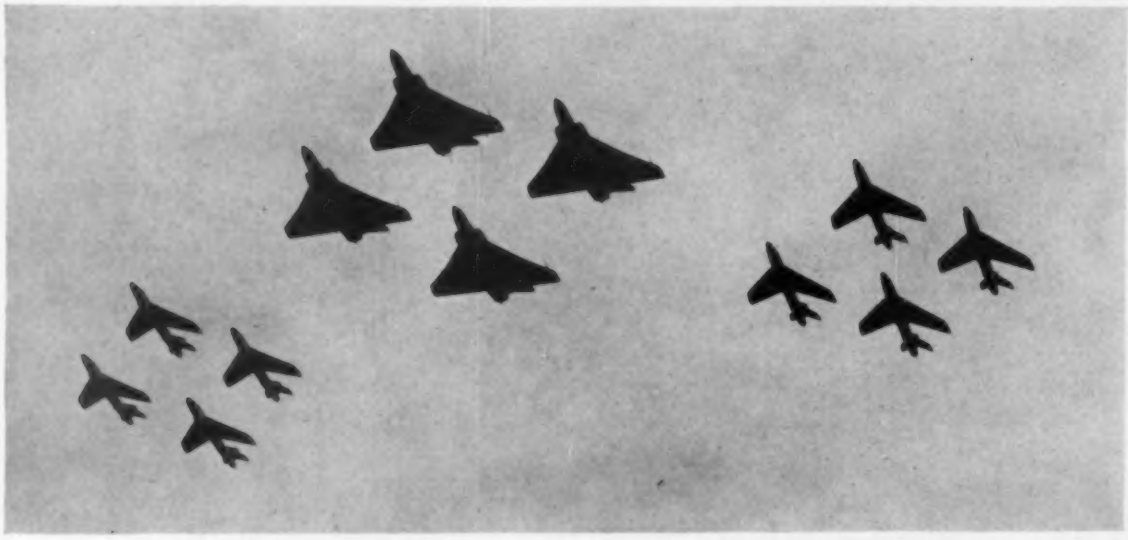
THE need for "a big helicopter which could operate over the Cyprus mountains" was stressed recently by Field Marshal Sir John Harding. Speaking to R.A.F. and R.N. personnel at Nicosia airfield, he said: "We need a machine to hover in the rarified tropical atmosphere over the island's mountains and forests. We need something bigger than Sycamores and are now experimenting with Whirlwinds. Maybe we want something even bigger—but I usually ask for what I want and what I ask for I get, if it is available."

Travelling Met. Exhibition

BETWEEN August 3 and 26 a travelling meteorological exhibition of interest to the general public and to schools has its first showing in a Leicester museum. From September 7 to 30 it will be at Nottingham, then at Burton in January and Warwick in February. Instruments will be shown working and a whole day's charts from the Central Forecast Office, Dunstable, will be on view. The exhibits have been prepared by the Meteorological Office in conjunction with the Information Branch of the Air Ministry.

Inside Information

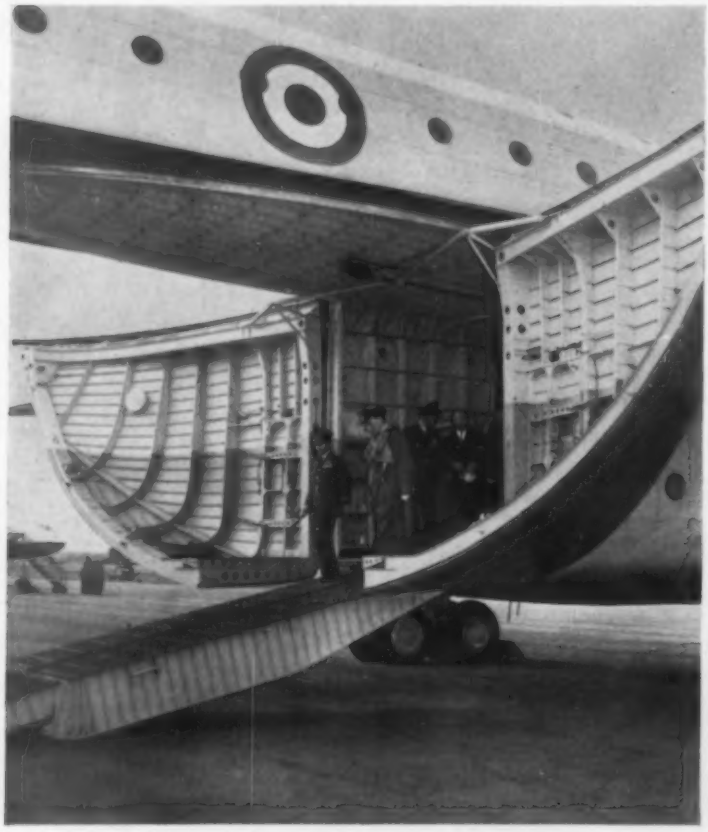
NINETEEN R.Aux.A.F. officers recently visited the English Electric guided weapons development centre and factory at Luton and Stevenage. The officers, from No. 500 (County of Kent) Sqn., based at West Malling and No. 3500 (County of Kent) F.C.U. at Margate, are the first "part-time" Air Force members to be given details of new weapons of this kind. They were told when the first English Electric missile would go into service and what its rôle would be, and were given other information which is still withheld from publication.

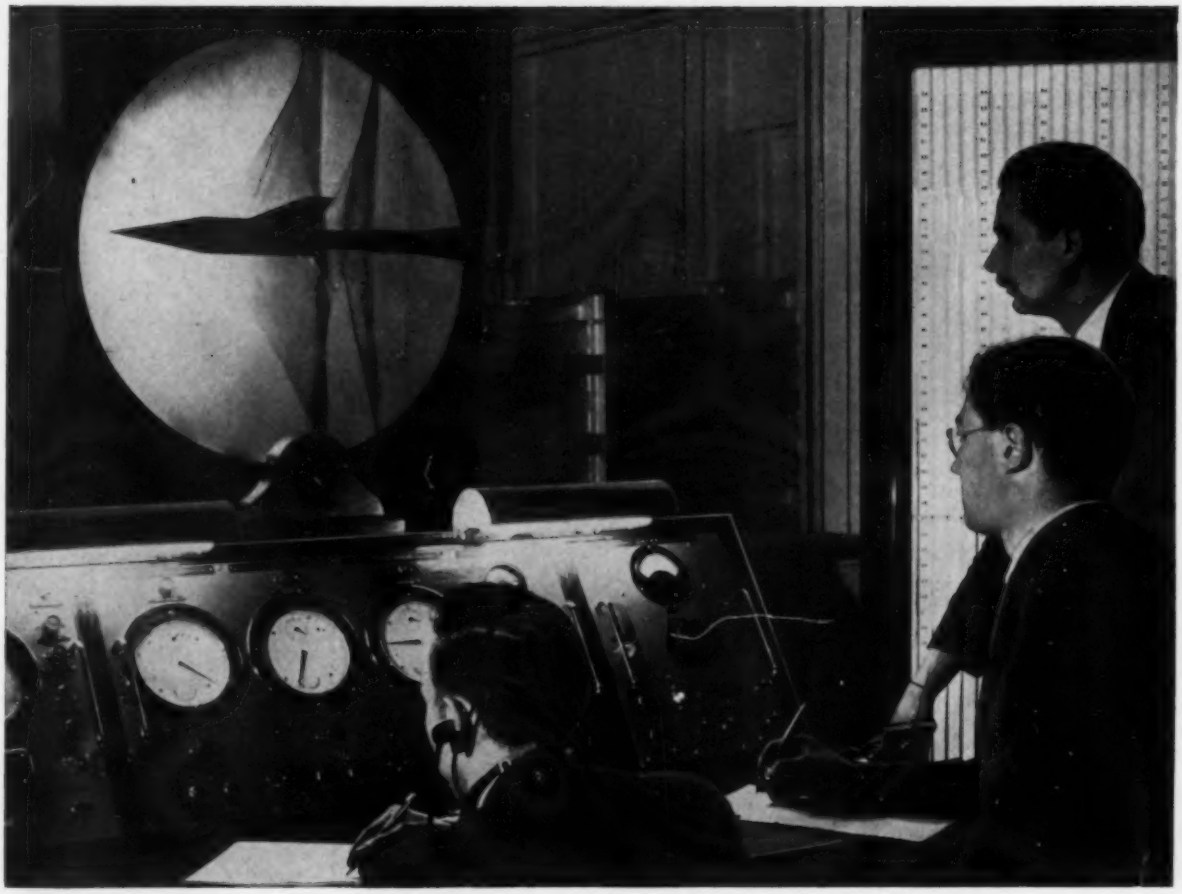


A King with the R.A.F.

The Visit of King Feisal of Iraq to Royal Air Force Station Odiham

ON the third day of his State visit to Great Britain, King Feisal of Iraq made the short journey from London to R.A.F. Station Odiham, Hants. The royal party included the Crown Prince and the Prime Minister, General Nuri es-Said, and was met by the Secretary of State for Air, Mr. Nigel Birch, the Vice-Chief of the Air Staff, Air Chief Marshal Sir Ronald Ivelaw-Chapman, and the A.O.C-in-C. Fighter Command, Air Marshal H. C. Patch. In the morning the King—who displayed a deep and knowledgeable interest—inspected a line of aircraft, comprising a de Havilland Comet 2, an English Electric Canberra, a Vickers Valiant, an Avro Vulcan, a Blackburn Beverley, a Hunting Percival Jet Provost, and a D.H. Vampire T.11. In the afternoon he saw a flying display, which included a mass take-off; aerobatics by two Hunters of No. 247 Squadron and by a No. 46 Squadron Javelin (which spent much of its time inverted); a formation of Javelins and Hunters (see the picture above); a display by the Jet Provost; aerobatics by four Hunters of No. 111 Squadron; and a quick turn-round and re-arm by a Hunter of No. 54 Squadron. Below, the King is talking with the pilot concerned in this last item—F/O. E. A. Lewis. On the left he is descending from the Beverley.





Tunnelling for facts

The aircraft designer's most powerful weapon is still the wind-tunnel, though not quite the same sort of wind-tunnel that was good enough before Professor Mach made his name. If you are in the business of making supersonic aircraft, you must have a supersonic wind-tunnel—or more precisely a supersonic tunnel that is also usable at transonic speeds, for it is just below and just above the speed of sound that really funny things happen to the air-flow round an aeroplane. To build such a tunnel poses two problems—how to move a vast quantity of air fast enough, and how to stop shock waves choking the tunnel at high subsonic speeds so that testing becomes unreliable at and near the speed of sound.

The first problem was solved by seizing on the casual remark of an ENGLISH ELECTRIC man over lunch 'Why not use a jet engine to blow or suck the air along?' The second was more difficult to solve, but finally yielded to hard work and clear thinking. As a result ENGLISH ELECTRIC had the first sizeable transonic wind-tunnel ever built in this country. To-day, indeed, they have two such tunnels, plus a low-speed one, and are pressing on with a new tunnel to run at several times the speed of sound. Thus the ENGLISH ELECTRIC design team is in a position unique in the British aircraft industry. Not only do they have the urge to find things out on the ground, but for several years they have had the means to do so.

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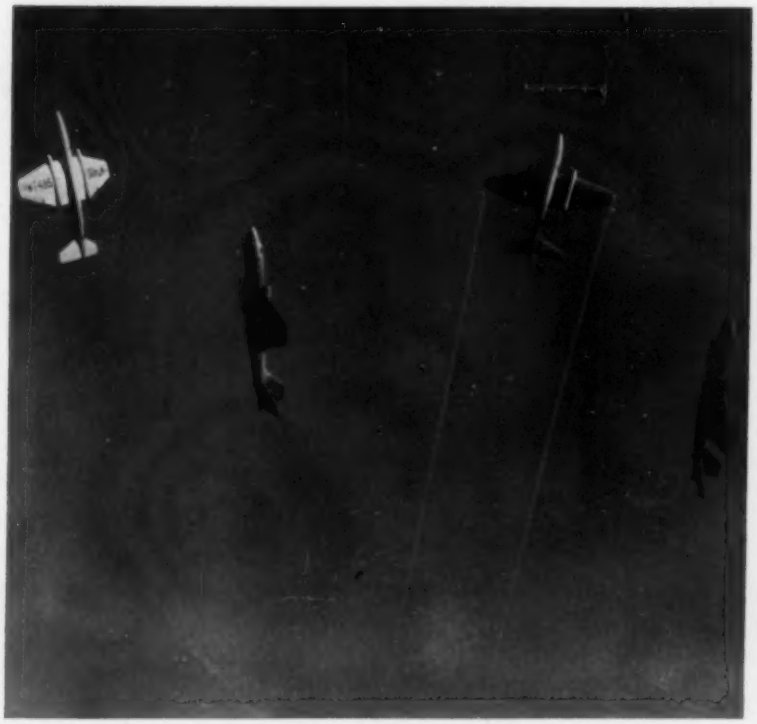
CANBERRA TEAMWORK

Brilliant Airmanship by No. 231 Operational Conversion Unit, R.A.F.



In these pictures Canberra T.4s of No. 231 O.C.U. are rehearsing for their item at the Coventry Air Pageant. Specially remarkable —and hitherto regarded as the "perk" of Fighter Command—is the "vertical bomb-bursts" as demonstrated on the left.

Members of No. 231 O.C.U., R.A.F. Bassingbourn, who were to form the team to demonstrate at Coventry last week-end (see report in this issue). L. to r.: F/L. E. R. Gordon, F/O. P. R. Newsome, S/L. F. P. Walker, A.F.C. (leader), F/L. L. N. Williams, F/L. J. A. Cowton, F/Sgt. W. H. Filling, F/L. J. W. Moore, and F/Sgt. H. Lomes.

Dramatis personæ: Jeffrey Quill, S/L. Jackson (working on the Blériot's engine), Richard Dimbleby, Peter Twiss, A. Cdre. Wheeler. Above, the Avro 504 and the Sopwith Pup performing for the cameras. The Pup's Vickers gun is mounted in an unorthodox manner.

"Flight" photographs

Veterans on TV

Shuttleworth Aircraft in BBC Programme

OLD WARDEN AIRFIELD, in Bedfordshire, is suggestive of the park of a country mansion—as, in fact, it is—and a day there among the veteran aircraft of the Shuttleworth Trust was not to be missed. A visit by a B.B.C. television film unit provided the opportunity; the next *Panorama* feature was to touch on the 47th anniversary of Blériot's crossing of the Channel, and A. Cdre. Wheeler invited *Flight* to come along and watch.

Though we have not seen the televised result at the time of writing, we can believe it to be none the worse, and probably better, for the absence of a shooting script. Producer Michael Peacock and his henchmen were apparently thinking the whole thing up as they went along; and with urbane Richard Dimbleby as interlocutor a trio of well-known pilots revealed unsuspected thespian abilities.

By way of introduction Mr. Dimbleby appeared at the wheel of a 1903 De Dietrich, incidentally conducting this thunderous *bolide* with considerable mastery. In the passenger seat was Mrs. Shuttleworth, who explained how the Trust and the agricultural college were founded in memory of her son, killed in the R.A.F.

Then A. Cdre. Wheeler told the interviewer something about the veteran aircraft, which were lined up outside the hangar: the 1909 Blériot (fan-type Anzani), 1911 Deperdussin (Y-type Anzani), 1912 Blackburn monoplane (50 h.p. Gnôme), Sopwith Pup (80 Le Rhône), Avro 504 (110 Le Rhône) and—a big chronological leap—a Mk 11 photo-recce Spitfire. Only the Bristol Fighter, now stabled at Cranfield, was absent. Next (we use the word figuratively, for each scene was shot out of sequence, in the best film-making tradition) the Blériot was brought out for Jeffrey Quill. Seated in it, Vickers-Supermarine's erstwhile chief test pilot (he is now sales manager) answered questions about its designer's historic achievement.

S/L. L. A. Jackson, who supervises the veterans with expertness and affection, was introduced to the microphone. Then Quill taxied out, with a fine old-fashioned *brrtt-brrtt-brrtt*, presently to become airborne to a dizzy 25ft before touching down in front of cameras on the far side of the field. This was quite an achievement for the Blériot and its 47-year-old engine.

Next A. Cdre. Wheeler beat up the cameras with the Pup—a revealing demonstration of how the little World War I fighter could be handled—and finally it was the turn of Lt.-Cdr. Peter Twiss, Fairey test pilot and world speed record holder, to take off in the 504, with Dimbleby as passenger, for air-to-air shots to be taken from an Auster.

Altogether a good day, nostalgically reminiscent (to one just old enough to remember it) of a more leisurely aviation era: the same long patient waits for this, that or the other; the same staccato thresh of rotary engines; the same unforgettable reek of castor oil.

And, of course, there was plenty of laughter—mainly over conversations that, perhaps fortunately, found no place in the soundtrack. Thus the occupants of the 504, awaiting the word to start:

Dimbleby (passenger, in dual-control rear cockpit): "I've got six lovely instruments here."

Twiss (pilot, in front cockpit): "You're lucky. I've got none."

Dimbleby: "Is it all right for this petrol to be trickling into my shoes? I suppose it's part of the flight plan?"

Wheeler (standing alongside): "Exactly. It shows the aircraft is serviceable."

* * *

An intensely interested visitor was Lt-Cdr. F. G. Tallman, U.S.N.R., of Glenview, Ill., a veteran-aircraft enthusiast who owns a Sopwith Camel (110 Le Rhône) and is now rebuilding a Pfalz D.XII (180 Mercedes) complete with original armament; he has also owned a Nieuport XXVIII and Spad S.VII. R.E.C.

(Left) the Blériot "in full flight." (Below) Deperdussin, Blackburn, Avro 504, Pup, Spitfire II, Blériot.

"Flight" photographs

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A Progress Report on Handley Page's Alvis-powered Branchliner

BY the time these words are read the Handley Page Herald may well have been awarded its special-category C. of A., an event which, although a routine matter in the development of a new airliner, is nevertheless always an occasion for satisfaction to the manufacturer concerned, and an opportunity to assess progress.

As will be seen on pages 157 and 158, full performance measurements have now been completed, and these provide the basis for performance guarantees to be offered. These guarantees would cover figures for cruising power, consumption, three- and four-engine climb, balanced field length for take-off, and take-off and landing distances. Earlier performance figures and technical descriptions have been published in *Flight* of August 19, 1955, and in our "Commercial Aircraft" number of July 6, 1956.

The second aircraft—pressurized, furnished and more fully representative of the production machines—is coming along according to programme (see picture on p. 169), and will be the aircraft demonstrated at the S.B.A.C. Display. It is scheduled to carry out tropical tests in Africa next April, and will probably be the aircraft allocated for intensive route trials next summer. It may be surmised that the airline most interested in carrying out this work will be Air Kruise, the British independent which has ordered six Heralds for its services between the U.K. and the Continent. Air Kruise will, in the summer of 1958, receive first production deliveries of the 100 aircraft for which jigging and tooling is being laid down at Woodley; deliveries to the other airlines which have so far stated their intention to purchase Heralds (Queensland, A.N.A., and Lloyd Aero Columbiano) will follow.

Engineering development of the Herald has been moving apace at Woodley, near Reading, the H.P. headquarters for Herald development and production. Much refinement of the systems has been achieved (particularly the electrics, which now have split busbar distribution), and two fuselages are respectively undergoing structural and pressure tests. Progress at Coventry with the Alvis Leonides Major engine is recorded on page 156.

Of especial interest in the pages which follow is a route analysis for the Herald (p. 153). While basic performance figures measured to a standard set of conditions—such as those reproduced on pages 157 and 158—enable an academic assessment of an aircraft to be made, it is the route analysis which today sells a commercial aeroplane. Handley Page's are firm believers in the policy of "sitting down" with the operator and making a detailed assessment of how the Herald fits into the routes out of which he makes his living. Forty-odd route analyses have to date been prepared, and it was particularly instructive to select one—for Aden Airways—to show the aircraft's commercial capabilities on a short-range, rough-country route, typical of those for which the Herald was designed.

Men behind the Herald: left to right, Mr. G. C. D. Russell, assistant managing director; G/C. R. C. M. Collard, sales manager; S/L. H. G. Hazelden, chief test pilot; Mr. R. J. Davies, chief aerodynamicist, H.P. Reading; Sir Frederick Handley Page; Mr. E. W. J. Gray, chief designer, H.P. Reading; and Messrs. J. T. Wilkinson and E. W. Pixton, respectively works superintendent and manager, H.P. Reading.

THE HERALD ADVANCES . . .

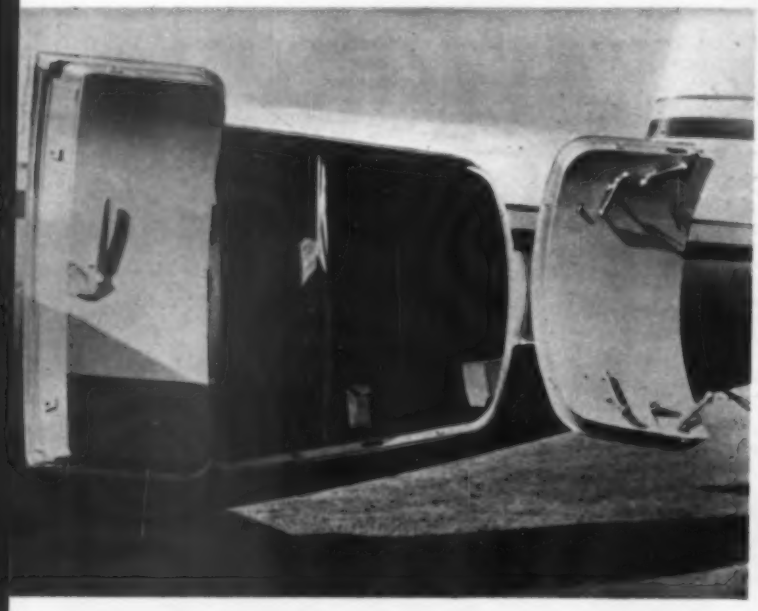
ROUND THE HERALD WITH A CAMERA

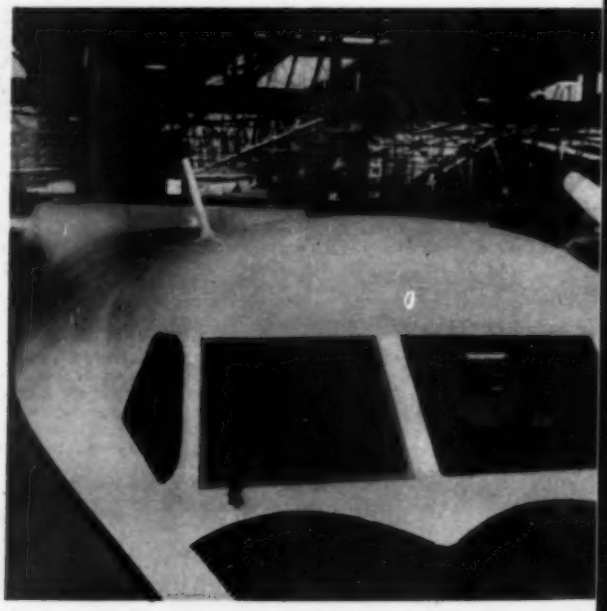
Easily detachable seats and partitions for the accommodation of varying freight loads are a feature of the Herald cabin (below). The standard version, with a seat pitch of 38in, provides for 36 passengers, although 44 passengers can be carried. Both versions include a toilet and baggage hold. The high wing affords an excellent view.

Identity feature—the large fin has a distinctive fluted light alloy skin. Leading edges of the fin and tailplane are de-iced thermally between the outer surface and chordwise corrugations on the inner skin. Note the sloping horn which carries the mass balance weights.

(Below, left) Freight entry to the 56ft long pressurized cabin is via the large double doors; passenger entry is via the forward door only. Alternative versions provide horizontally divided doors incorporating passenger steps in the lower half. Crew access, at the front of the cabin, is via another portside door which is large enough to accommodate oil drums.

(Below, right) The neat cockpit of the Herald provides big windows with a good view over the nose for both pilots. A photograph of the cockpit interior appears on page 151.





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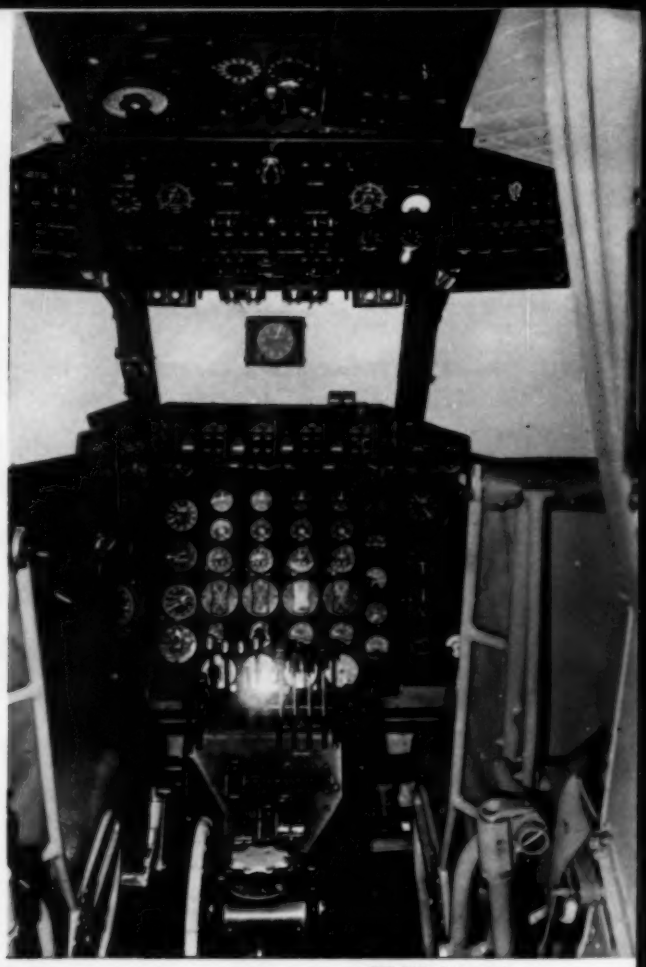
(4 Alvis Leonides Major engines)

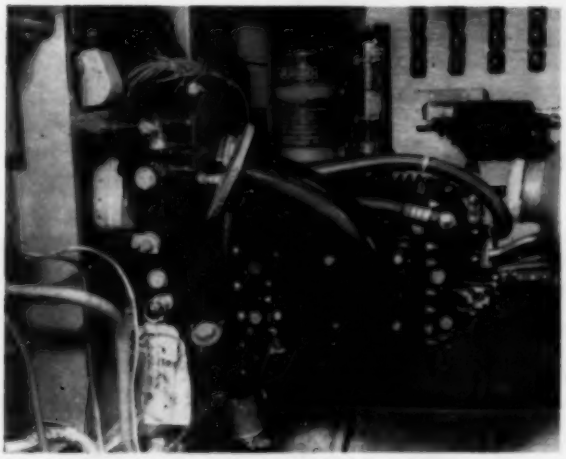
THE HERALD ADVANCES . . .

Round the Herald with a Camera (Continued)

The cockpit (right) of the prototype Herald. The deep centre panel contains the engine and pressurization instruments; the fuel flow-meters seen behind the throttle and r.p.m. levers are to special order. Radio, de-icing, fuel and electrical services are mounted overhead, and secondary engine controls are mounted on the coaming panel. Fitted in the centre of the windscreen is a test accelerometer.



"Flight" photograph



Godfrey cabin blowers are driven from the outer engines through a gearbox. The ducting had been removed when this photo-graph was taken. Note the Graviner fire-extinguisher bottles.

Component composite: Goodyear wheels, disc-brakes and tyres are mated to an Electro-Hydraulics undercarriage. The brakes are non-differential as the nosewheel is steerable from a hand-wheel on the pilot's control column. Anti-skid units can be fitted to the wheels if operators require them.

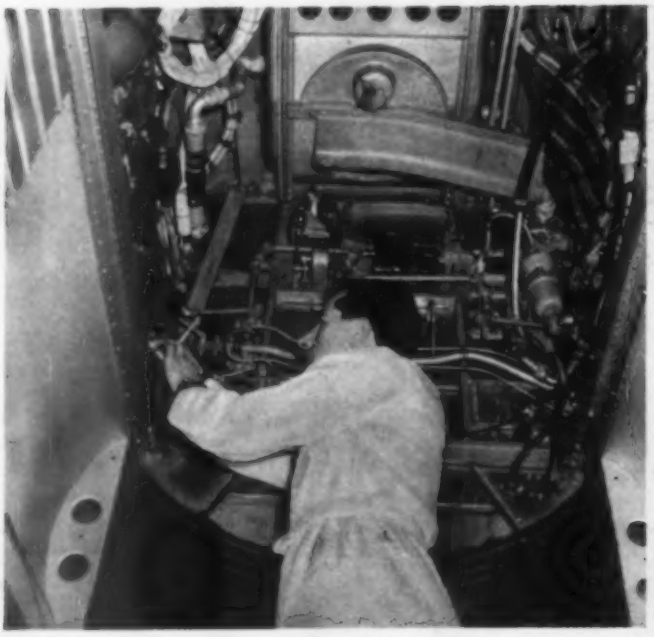
Extended by a system of Electro-Hydraulic jacks and cables, the Herald's large flaps retract neatly under the wing. Note the extension fairings on the flap under-surface.

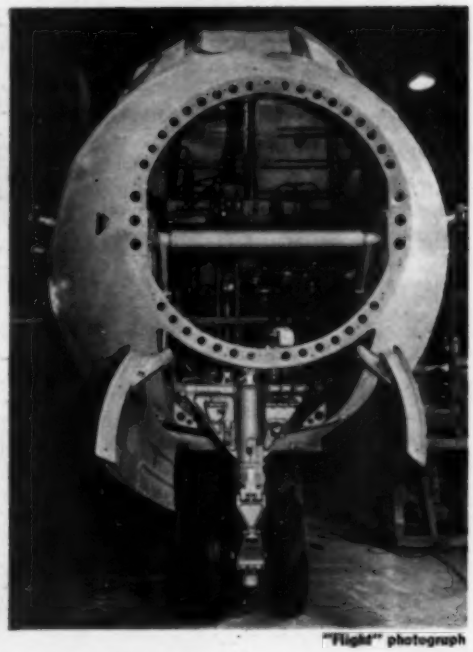
"Flight" photograph

THE HERALD ADVANCES . . .

Round the Herald with a Camera (Continued)

Petal cowlings allow unrestricted access for removal of the Alvis Leonides Major powerplant, although routine servicing requires only the side and lower panels to be opened. De Havilland 11ft feathering airscrews with auto pitch-coarsening are employed. All refuelling operations are performed from above the wing.





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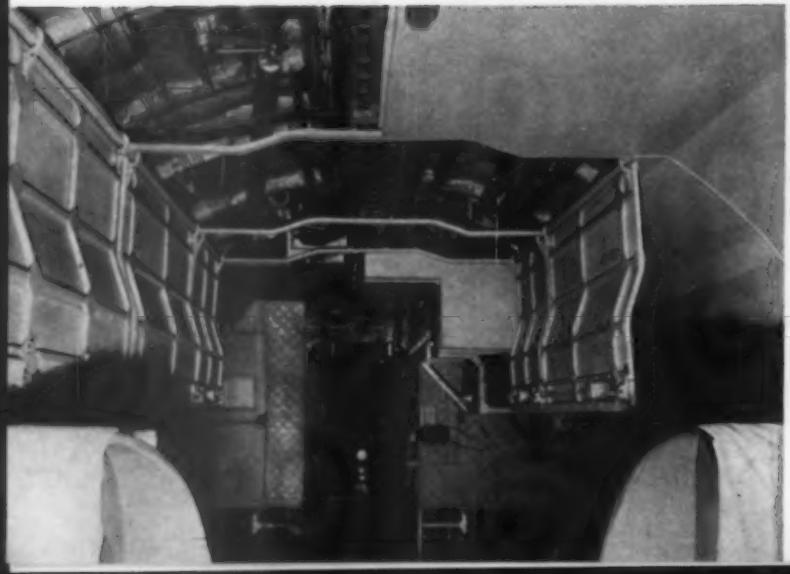


GROUPED SERVICING:—

The picture (left, above) of an inboard nacelle shows adjustments being made to the fuel system. Overhead is the oil tank and undercarriage stoneguard, and to the right, the Puralator feathering-oil-filter.

Access to the forward servicing panel (above), where most equipment is positioned at a convenient working height, is via the nosewheel-bay doors. High on the panel, but still within reach, is the transparent reservoir for brake fluid, and farther below is the electric and hydraulic steering mechanism.

(Left) Control run inspection is made easy when panels are removed from the floor and the hinged panels shown here are lowered from the roof. The high floor of the pilot's cockpit provides excellent access for servicing under-floor equipment.

THE HERALD ADVANCES . . .

ROUTE ANALYSIS

Bringing the H.P. Airliner's Performance to Life

ON this page we reproduce an actual route analysis for the Herald. It was prepared for Aden Airways, a B.O.A.C. subsidiary at present equipped with DC-3s and Dragon Rapides, according to data supplied by the airline. All told, more than 40 such route studies have been made for potential Herald purchasers.

The map shows the sectors under consideration, with their lengths, and the tables provide appropriate route and airfield data together with the payloads, block times and fuel required under both visual and instrument and flight rules. The version of the Herald under consideration is the 36-seater, of which the capacity payload is 10,100 lb. It will be seen that the maximum take-off weight of 37,500 lb is, for reasons of runway length, limited at Mukeiras and Addis Ababa to respectively 34,000 lb and 36,300 lb.

The payloads quoted in the tables are related to the basic equipped weight of 25,780 lb. This results, on some of the stages, in the payload being greater than the capacity payload limited by minimum fuel and oil. In these instances take-off weight has to be reduced by the excess of payload above the capacity payload.

Block time allows seven minutes for start, checks, taxi and take-off; five minutes for climb, cruise, descent, circuits and landing; and four minutes for taxi after landing.

Fuel required includes 16.4 gal for the seven-minute item above; 9.8 gal for the five-minute item above; and 2.1 gal for the four-minute item above. Under I.F.R. conditions it is assumed that the flight to the alternate is made from the circuit height of the destination aerodrome. Cruising is at 50 per cent M.E.T.O. power, and a stand-off of 45 min at the alternate is included. Under V.F.R., an allowance of 45 min stand-off at 1,000ft is made at the destination aerodrome (stand-offs are made under cruising threshold speed conditions). Fuel allowances for contingencies are: 1.5 per cent *en route* and 5 per cent overall. Oil quantities are assessed proportionally to the fuel load with a four-gallon allowance for feathering.

Performance conditions assumed are as follows: take-off and landing weights, still air, are assessed according to I.C.A.O. requirements with airfield elevation and temperature effects included. Take-off and landing weights, for example, are controlled by (1) rate of climb on three engines (Annex 8); (2) aerodrome runway length, elevation and temperature (Annex 6); (3) runway bearing strength; (4) maximum design take-off and landing weight (37,500 lb); and (5) volumetric capacity 10,100 lb. Over the shorter stages where this latter payload can be carried, the fuel load is such that maximum take-off weight may not be reached. The maximum zero fuel weight of 35,880 lb must of course not be exceeded. Take-off, approach and baulked landing net flight paths in accordance with I.C.A.O. Annex 8.

For example, for take-off net flight path, the minimum three-engine rate of climb shall be the lesser of 0.35 V_{si}^2 or 0.38 $V_{si}^{1.5}$ ft/min, where V_{si} is the power-off stalling speed or minimum steady flight speed, m.p.h., in the following conditions (1) inoperative airscrew in auto-coarse pitch; (2) remaining engines operating within take-off power limitations; (3) landing gear retracted; (4) wing flaps in the appropriate take-off position corresponding with the flap control setting at the critical point; (5) cowl flaps and radiator shutters in the position relative for normal use during take-off; (6) aeroplane weight equal to maximum take-off weight appropriate to the altitude; (7) air speed equal to the take-off safety speed.

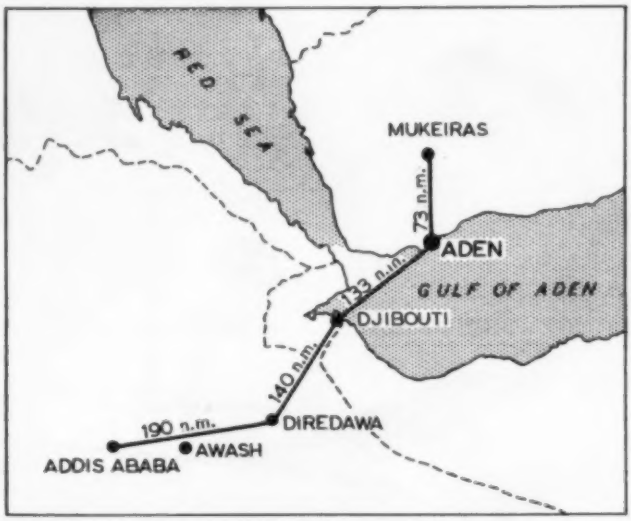
ROUTE DATA

SECTORS

Stage	Safety height (ft)	Distance (n.m.)
Mukeiras—Aden	8,000	73
Aden—Djibouti	1,500	133
Djibouti—Diredawa	5,000	140
Diredawa—Addis Ababa	8,000	190

AIRFIELDS

Aerodrome	Elev. (ft)	Max. amb. temp (deg C)	Runway length (yd)	Alternate	Dist. (n.m.)
Mukeiras	6,600	38	1,700	Aden	73
Aden	10	39	2,795	Mukeiras	73
Djibouti	23	35	1,970	Aden	133
Diredawa	3,950	30	1,330	Awash	113
Addis Ababa	7,749	27	1,900	Awash	82



Four sectors from the route-network of Aden Airways, an ultra-short-haul local-service operator in a region of mountainous terrain and hot, high airfields. It is the kind of territory which inspired the design of the Herald.

ROUTE PERFORMANCE

SPEEDS

Stage	Headwind kt	Block Time hr min	Block Speed kt
Mukeiras—Aden	0	0 43	103.0
Return	9	0 47	93.4
Aden—Djibouti	0	1 10	115.3
Return	9	1 10	114.0
Djibouti—Diredawa	0	1 11	118.8
Return	9	1 13	115.4
Diredawa—Addis Ababa	0	1 29	127.6
Return	9	1 31	125.7

PAYLOADS

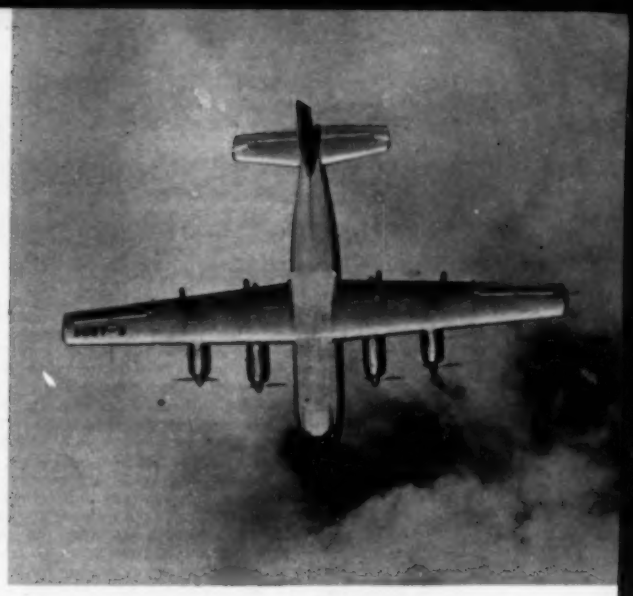
Stage	Payload (lb) I.F.R.	Payload (lb) V.F.R.	Take-off weight (lb) I.F.R.	Take-off weight (lb) V.F.R.
Mukeiras—Aden	6,535	7,140	34,000	34,000
Return	10,008	10,100	37,500	37,252
Aden—Djibouti	9,576	9,965	37,500	37,130
Return	9,853	10,100	37,500	37,309
Djibouti—Diredawa	9,270	10,015	37,500	37,500
Return	9,408	10,100	37,500	37,353
Diredawa—Addis Ababa	9,282	9,800	37,500	37,500
Return	8,051	8,750	36,300	36,300

FUEL

Stage	Fuel (Imp. gal) I.F.R.	Fuel (Imp. gal) V.F.R.	Block Fuel Consumption gal/hr
Mukeiras—Aden	214.8	130.4	116.6
Return	217.8	170.6	138.4
Aden—Djibouti	275.7	176.0	108.5
Return	236.8	181.0	106.4
Djibouti—Diredawa	314.4	218.0	133.9
Return	296.1	187.1	107.7
Diredawa—Addis Ababa	313.2	244.7	122.0
Return	315.5	225.9	109.3

THE HERALD ADVANCES...

FLIGHT,
27 July 1956
154-155



AERIAL ASPECTS

BEAUTY, it is said, is in the eye of the beholder, while some will have it that handsome is as handsome does. But if either premise be accepted the Herald is in little need of apology. That it has an individual air of businesslike trimness is beyond contention, and its proportions—like its four engines—instil confidence. As for "doing," the data presented in this issue are eloquent enough. Of these pictures by L. W. McLaren the large view is, we believe, the most characteristic of all, portraying to the life this promising new contender in the world's markets.

THE HERALD ADVANCES . . .

Engines and Airscrews

The Alvis Engines

POWER for the Herald is provided by four Alvis Leonides Major 14-cylinder, two-row, air-cooled radial engines. Maximum take-off power rating is 866 b.h.p. at 3,000 r.p.m. and +9½ lb/sq in boost. A stiff, three-piece, barrel-type forged crankcase joined on the centre-line of the cylinders forms the basis of the engine, and the cylinder flanges afford additional crankcase stiffness. The crankshaft is also of built-up construction in three sections joined on the vertical centre-line of each crankpin. The sections are registered by two externally splined hollow couplings, which pass through the centre of each crankpin, and the assembly is locked by special draw bolts which engage opposite-handed threads in the appropriate section of the shaft. Three roller-type bearings, each located in a section of the crankcase, carry the journal loads, and end thrust is taken by a ball thrust bearing in the front cover.

The connecting-rod assemblies are paired, and consist of a one-piece master rod with six articulated rods attached. The articulated connecting rods have phosphor-bronze bushes at both wrist and gudgeon-pin ends, but the master rods (operating in cylinders number 4 and 11) have a steel-based, white-metal, shell-type bearing at the crankshaft end. This bearing is prevented from rotating by an internal spline.

Each cylinder assembly consists of a deeply forged steel barrel with a nitride-hardened bore, screwed and shrunk into a cast Y-alloy cylinder head. Also shrunk into the head are stainless-steel sparking-plug adaptors, bronze valve guides and austenitic-steel valve-inserts. The valves are of austenitic steel with Stellited tips; the exhaust valves are sodium-filled and have "Brightray" heads. Contact between the valve stem and rocker is made by a flattened ball carried in an adjusting screw. The valves and pressure-lubricated valve operating mechanism are contained in separate oil-tight housings, and access is by means of a light alloy cover held in position by four studs.

The valve gear is operated by two cam rings, one in front of and the other behind the power section assembly, each driven by gearing from the crankshaft. The cam rings are mounted on phosphor-bronze bearing sleeves attached to shelves forming part of the crankcase front and rear halves. Roller-type tappets, push rods and rockers operate the valves.

The pistons, machined from aluminium-alloy forgings, are each fitted with two taper-sided compression rings and two scraper rings. The top scraper ring is a high-pressure type with oil drainage drillings through the ring, and is fitted immediately below the compression rings; the lower scraper ring is of medium pressure and is fitted at the base of the piston skirt. The gudgeon-pin bosses are situated well within the circumference of the piston, thereby centralizing the thrust; the pins are fully floating.

A single-speed, single-stage supercharger is fitted. The feed is *via* a seven-vane diffuser to an annular delivery chamber. The supercharger spring drive, which is splined to the crankshaft, drives two layshafts. These shafts, and the gears driving the impeller, are housed in the space between the inner face of the diffuser casing and the flanged inner section of the supercharger casing. The impeller is mounted on a hollow steel hub on the rear-cover internal drive-shaft, and runs in phosphor-bronze bushes.

Metered 100-octane fuel, to suit engine requirements under varying conditions, is supplied to the eye of the supercharger impeller by a Hobson fuel-injection carburettor, and is discharged under pressure through a valve into a slinger ring rotating with the impeller. This system enables single-lever engine control to be employed. To avoid any likelihood of induction-passage icing, the throttle and throttle body are oil-heated. Engine lubrication is by separate pressure and scavenge pump assemblies and coarse and fine mesh filters are incorporated in the system. A pressure operated valve ensures that oil cannot drain from the tank into the engine after shut-down.

The reduction gear to the parallel-splined, S.B.A.C. No. 4 size airscrew shaft is of the Farman type. Six satellite pinions are employed to give a reduction ratio of 0.533 to 1. The engine is closely cowled by four petals and baffled to provide satisfactory cooling for tropical operation, protracted taxying and climb.

Over 1,000 hours' flying time have been accumulated to date, and special-category approval has been obtained.

The de Havilland Airscrews

The Leonides Major engines drive three-blade de Havilland Hydromatic airscrews of 11ft diameter. The basic unit on which each airscrew is assembled is a spider—a high-tensile steel forging machined to fit the splines of the engine shaft. Three hollow-shank duralumin blades are retained to the arms of the spider by a two-piece steel barrel upon which is mounted a pitch change mechanism. This mechanism consists mainly of a duralumin dome, acting as a stationary cylinder within which a forged-duralumin piston operates. Formed in the wall of the piston is a cavity, housing a pair of co-axial cylindrical cams; the outer cam is fixed with relation to the airscrew hub and is called the stationary cam, whilst the inner cam is free to turn and is known as the rotating cam. Linking the two walls of the cavity in the piston, through slots in the cams, are four sets of shafts and rollers, the purpose of which is to translate the longitudinal movement of the piston into rotational movement of the rotating cam. This is achieved through specially shaped cam slots and, since the slots are cut in opposite directions in the two cams, the forward and twisting movement of the piston over the slots of the stationary cam causes a doubled rotational movement of the rotating cam. This rotation is transmitted to all blades simultaneously through a gear ring on the rotating cam and a gear segment on each blade, and so produces an increase or decrease of blade angle proportional to the movement of the piston. The range of movement of the rotating cam, and consequently the pitch range of the blades, is limited by two stop-bolts incorporated in the gear ring; the travel of the stop-bolts, and consequently the gear ring, is arrested by feather- and fine-pitch stop rings.

The pitch-change mechanism incorporates an automatic pitch-lock which operates in the event of a failure of the controller or its oil supply, thus preventing the natural tendency of the blades to assume fine pitch, with consequent overspeeding.

A double high-pressure controller, so called because both oil supplies to the airscrew originate from the controller pump, is used with each airscrew. The controller is engine-driven and consists of a gear-type pump with relief valve and a governor-operated control valve which determines the direction of the flow of oil to and from the airscrew. A further relief valve, incorporated in the fine-pitch line of the controller, acts as a spill-valve for surplus oil delivered by the gear pump to the fine-pitch line.

A special feature of the controller is an automatic pitch-coarsening device which operates in the event of an engine failure under take-off conditions. This device consists of a solenoid-operated coarse-pitch valve which, when initiated electrically, allows high-pressure oil to move the blades to coarse pitch irrespective of the position of the control valve; the "drag" which would otherwise result before the airscrew could be feathered is thus reduced to a minimum. A reverse-pitch valve which is part of the "braking" system of a braking type airscrew is also incorporated in the controller, but is made inoperative in this instance.

The feathering equipment, comprising motor/pump unit, pilot's operating switch, and pressure cut-out switch, operates the airscrew into feathered pitch independently of the engine lubrication system, from which the airscrew oil supply is normally drawn, and relies upon the aircraft battery for its power supply so that it can function in the event of engine failure.

The spinner shell is of moulded laminated-fibre glass, attached to an aluminium-alloy backplate by self-locking screws. The front support, which in the more conventional type of spinner is a separate unit, is an integral part of the spinner shell.

Thermal-electric de-icing is used, and consists of a wire-woven synthetic-rubber heater unit bonded to the leading edge of each blade. The elements are energized through hub-mounted slip rings from an electrical circuit which includes a variable-speed cyclic timer. The cyclic-timing system allows ice to form on the leading edge of the blade during the "off" period and adhesion is broken during the "on" period when the ice itself acts as a thermal insulator.

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Bon Voyage

and many happy landings

to the

Handley Page "Herald"

with best wishes from

Shell Aviation Service

YOU CAN ALWAYS BE SURE OF SHELL

THE HERALD ADVANCES . . .

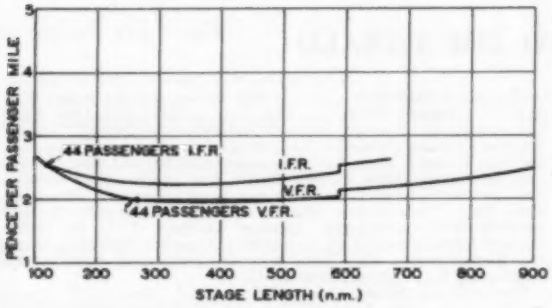
WEIGHTS, PERFORMANCE AND LEADING DATA

PRESENTED on this and the following page are: (1) a performance summary, based on the measured results of prototype tests; (2) an estimated weight analysis for the production aircraft; (3) payload-range data; (4) a selection of graphs to illustrate cost, payload-range, take-off and rate of climb. A table of leading particulars appears also on the next page.

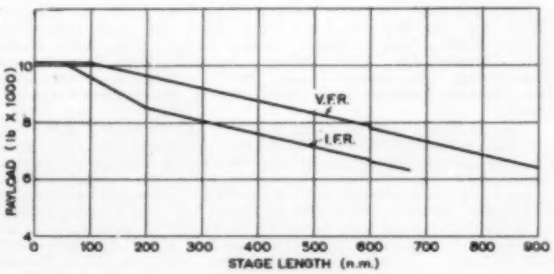
PERFORMANCE SUMMARY
(July, 1956)

Take-off, sea level, 37,500 lb:—	I.S.A.		I.S.A. + 30 deg C	
Ground run	565 yd		734 yd	
Total distance to 50ft, four engines	701 yd		893 yd	
Balanced field length	976 yd		1,238 yd	
Climb gradient, u/c down, one airscrew auto-windmilling	4.78 per cent		2.94 per cent	
Take-off speed	86.5 kt e.a.s.		86.5 kt e.a.s.	
Rate of climb, flaps and u/c up	1,370ft/min		1,055ft/min	
Climb, rated power, 37,500 lb:—	**4 eng.**	**3 eng.**	**4 eng.**	**3 eng.**
Rate of climb at sea level	980ft/min	470ft/min	760ft/min	280ft/min
(Time to 10,000ft 10 min)	440ft/min	—	80ft/min	—
Rate of climb at 15,000ft	19,900ft	13,000ft	14,800ft	8,000ft
Service ceiling	21,600ft	14,600ft	16,200ft	9,600ft
Absolute ceiling				
Landing, sea level, 37,500 lb, 10 deg descent gradient:—				
Stalling speed	70 kt e.a.s.		70 kt e.a.s.	
Approach speed (1.3 V_S)	91 kt e.a.s.		91 kt e.a.s.	
Touch-down speed	84 kt e.a.s.		84 kt e.a.s.	
Distance from 50ft	300 yd		313 yd	
Ground run	449 yd		497 yd	
Total distance from 50ft	749 yd		810 yd	
Level speed at 36,000 lb, I.S.A. conditions, four engines:—	**Max. weak mix. T.A.S.**		**Max. cont. power T.A.S.**	
Sea level	161 kt		193 kt	
10,000ft	186 kt		214 kt†	
15,000ft	192 kt*		205 kt	

* 195 kt at 13,350ft. † 216 kt at 8,100ft.



Pence per passenger mile versus stage-length, assuming 3,000 hr annual utilization, calculated according to the S.B.A.C. Standard Method.



Payload versus stage-length, shown for I.F.R. and V.F.R. fuel allowances, assuming I.S.A. conditions, still-air, and cruising at 50 per cent M.E.T.O. power.

ESTIMATED WEIGHT ANALYSIS
36-seat production Herald

	lb	Gross weight per cent
Mainplane	4,365	11.64
Fuselage	2,986	7.97
Tail unit	987	2.63
Landing gear	1,625	4.33
Nacelle structure and fairing	830	2.21
Total Structure	**10,793**	**28.78**
Engines (Leonides Major)	4,920	13.12
Mountings, cowlings, air intakes, etc.	752	2.00
Engine cooling system	175	.47
Exhausts, accessories, etc.	700	1.87
Airscrews, including spinners and controls	1,175	3.13
Total Powerplant	**7,722**	**20.59**
Permanent fuel tanks and supports	204	.54
Fuel system	190	.51
Oil tanks, supports and system	535	1.43
Residual fuel and oil	230	.61
Total Fuel and Oil	**1,159**	**3.09**
Hydraulics	435	1.16
Electrics	1,397	3.73
Flying controls	364	.97
Total Airframe Services	**2,196**	**5.86**
Instruments	203	.54
Anti-icing system	292	.78
Fire precautions	192	.51
Total Airframe Equipment	**687**	**1.83**
Air conditioning	411	1.10
Soundproofing	127	.34
Flight crew furnishings	105	.28
Fixed Furnishings	**643**	**1.72**
Total Empty Weight (all versions)	**23,200**	**61.87**
Radio	430	1.15
Partitions, decorations, passenger furnishings and equipment: Galley	482	1.28
Toilet	110	.29
Baggage	122	.33
	30	.08
Miscellaneous furnishings	20	.05
Seats in passenger cabin	684	1.82
Passenger service items	108	.29
Emergency items	55	.15
Basic Operational Weight	**25,241**	**67.31**
Flight crew and baggage	374	1.00
Stewardess and baggage	165	.44
Total Crew	**539**	**1.44**
Basic Equipped Weight	**25,780**	**68.75**
Maximum payload	10,100	26.93
Maximum Zero Fuel Weight	**35,880**	**95.68**
Minimum fuel and oil	1,620	4.32
Maximum Take-off Weight	**37,500**	**100.00**

PAYLOAD—RANGE

	5,000ft		10,000ft		15,000ft	
Maximum payload	10,100 lb	*10,100 lb*	10,100 lb	*10,100 lb*	10,100 lb	*10,100 lb*
Range with maximum payload	243 n.m.	*225 n.m.*	234 n.m.	*211 n.m.*	215 n.m.	*209 n.m.*
Payload for 500 n.m.	8,900 lb	*8,740 lb*	8,900 lb	*8,690 lb*	8,800 lb	*8,710 lb*
Payload with full tanks	6,395 lb	*6,395 lb*	6,395 lb	*6,395 lb*	6,395 lb	*6,395 lb*
Range with full tanks	1,048 n.m.	*967 n.m.*	1,061 n.m.	*956 n.m.*	1,064 n.m.	*989 n.m.*
Ultimate range, zero payload, full tanks	1,106 n.m.	*1,003 n.m.*	1,135 n.m.	*993 n.m.*	1,167 n.m.	*1,043 n.m.*
Mean cruising speed at mean 36,000 lb weight	154 kt	*173 kt*	158 kt	*186 kt*	158 kt	*192 kt*
Mean fuel consumption	103 gal/hr	*125 gal/hr*	103 gal/hr	*132 gal/hr*	102 gal/hr	*132 gal/hr*

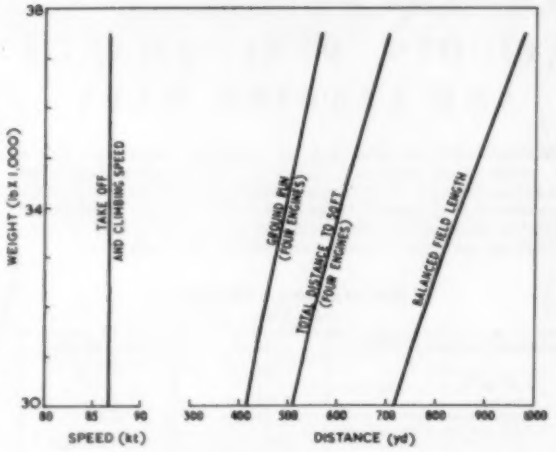
Note: The above table is for the 36-seater version, with normal 700 Imp. gal tankage. Figures include fuel allowances for take-off, climb, cruise, and descent; those in italics are for max. weak mixture power, the others for 50 per cent M.E.T.O. power (370 h.p.).

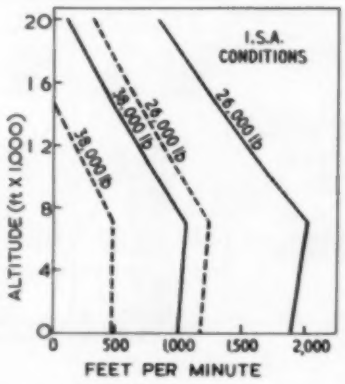
THE HERALD ADVANCES . . .

Weights, Performance and Leading Data (Contd.)

LEADING PARTICULARS

Fuselage	
Overall length	70ft 3in
Maximum diameter	9ft 2in
Cabin length (gross)	42ft 0in
Cabin height	6ft 3in
Maximum cabin height under wing	5ft 11in
Cabin width	8ft 6in
Cabin volume	2,070 cu ft
Mainplane	
Span	94ft 9½in
Wing area	886 sq ft
Root chord	12ft 0in
Tip chord	6ft 3in
Aspect ratio	10.2
Taper ratio	2.0
Aileron area (each)	29.7 sq ft
Flap area (each)	81 sq ft
Tail unit	
Tailplane span	36ft 9½in
Tailplane area (gross)	252 sq ft
Tailplane root chord	8ft 0in
Tailplane tip chord	4ft 8in
Elevator area (aft of hinge)	71.13 sq ft
Fin and rudder area	193 sq ft
Overall height of aircraft	22ft 4 in
Tankage	
Fuel capacity	700 Imp. gal
Oil capacity	40 Imp. gal
Undercarriage	
Track	22ft 0in
Wheel-base (leg centre)	24ft 2in
Size of main wheel	34 x 11.75-14
Size of nose wheel	23 x 7.25-10
Tyre pressures (maximum)	50 lb/sq in





Above, take off on three and four engines, for I.S.A. conditions, sea level, and with the inoperative airscrew windmilling in auto-coarse pitch.

Right, climb on four engines (unbroken line) and three engines (broken line), at max. gross weight of 37,500 lb and max. continuous 2,900 r.p.m.

CONTRIBUTORS TO THE HERALD

THE following is a list, provided by the manufacturers of the aircraft, of firms who have supplied materials, components and equipment for the Herald:—

Accles and Pollock, Ltd., steel tubing; Acton Bolt, Ltd., bolts; Aero Controls, Ltd., rudder bars; Aircraft Materials, Ltd., A.G.S. and A.S. parts; Alvis, Ltd., engines; Amal, Ltd., flame traps, fuel filters; Automotive Engineering, Ltd., circlips; Automotive Products, Ltd., filters, pumps, couplings; Aviation Developments, Ltd., Avdel and Chobert rivets, Pip pins; Bakelite, Ltd., resins, fabric and paper base sheet; Barter Trading Corpn., Beetle cement; Baxters, Ltd., bolts, rivets; B.B. Chemical Co., Ltd., sealing compound; Bells Asbestos and Engineering, Ltd., fireproof seals; Birmetals, Ltd., aluminium alloy bar; Bloctube Controls, Ltd., pilots' console, engine remote controls system.

Thomas Boorn and Co., Ltd., fuel hose and fittings; J. Booth and Co., Ltd., aluminium alloy bar and extruded sections; British Aluminium Co., Ltd., aluminium alloy sheets and strip; British Insulated Callenders Cables, Ltd., aircraft electric cables; British Plywood Manufacturers, Ltd., aero plywood and metal-faced ply; British Thomson Houston Co., Ltd., circuit breakers; British Wire Products, Ltd., steel cable assemblies; T. J. Brocks (Autos), Ltd., bolts; Brown Bayley Steels, Ltd., steel bar and sheet; Brown Bros. (Aircraft), Ltd., A.G.S. and A.S. parts, steel bar; Bruntons (Musselburgh), Ltd., swaged cable assemblies; Burgess Products, Ltd., micro switches; B.X. Plastics, Ltd., "Cobex" sheet; Chelton (Electrostatics), Ltd., aerial masts; Howard Clayton-Wright, Ltd., "Nylastic" cable clips; Clevedon Rivets and Tools, Ltd., A.S. rivets; Cork Manufacturing Co., Ltd., cork jointing and sealing washers.

De Havilland Propellers, Ltd., airscrews; De La Rue and Co., Ltd., plastic furnishing sections; Delaney Gallay, Ltd., heat exchangers; Diamond Screw and Cotter Co., Ltd., A.G.S. parts; Docker Bros., Ltd., paints; Dowty Equipment, Ltd., switches and seals; Dunlop Rubber Co., Ltd., flexible pipes; Dzus Fasteners (Europe), Ltd., fasteners; Electro-Hydraulics, Ltd., undercarriage and hydraulic equipment; English Electric Co., Ltd., actuators and fuses; English Steel Corpn., steel bar; Erma, Ltd., terminal lugs; Fibreglass, Ltd., soundproofing materials; Fireproof Tanks, Ltd., fuel tanks; General Electric Co., Ltd., reading lamps, buffet equipment; Sir George Godfrey and Partners, Ltd., cabin superchargers; Goodyear Tyre and Rubber Co., Ltd., wheels, tyres and brakes; Graviner Mfg. Co., Ltd., fire-extinguisher equipment; Guest Keen and Nettlefold, Ltd., anchor nuts.

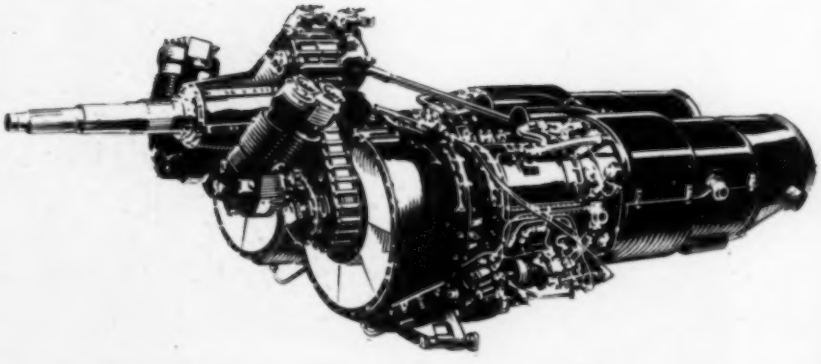
Hall and Hall, Ltd., rubber seals; Harley Aircraft Landing Lamps, landing lamps; Hellermann, Ltd., marker sleeves, pressure bungs; W. T. Henley's Telegraph Works Co., Ltd., electric cable; High Duty Alloys, Ltd., castings and forgings; Hoffman Manufacturing Co., Ltd., bearings; Imperial Chemical Industries, Ltd., Perspex; W. Jessop and Sons, Ltd., steel bar; E. and E. Kaye, Ltd., aluminium alloy bar and tube; G. Kent, Ltd., flowmeters; King Aircraft Corpn., Ltd., quick-release fasteners, drain valves; Linread, Ltd., rivets and bolts; Manganese Bronze and Brass, Ltd., Oilite bushes; Marconi's Wireless Telegraph Co., Ltd., direction-finding equipment; Marston Excelsior, Ltd., oil coolers; Midland Aeroquipment, Ltd., door locks and handles; Minnesota Mining and Manufacturing Co., Ltd., printed identification tape; Mollart Engineering Co., Ltd., universal joints.

Nettlefold and Moser, Ltd., A.G.S. and A.S. parts; L. H. Newton and Co., Ltd., bolts; J. C. Nicklin, Ltd., steel bar; Normalair, Ltd., cabin pressure and air conditioning equipment; Northern Aluminium Co., Ltd., aluminium alloy bar, sheet and extrusions; J. Penny and Co., Ltd., steel bar and sheet; Pianoforte Supplies, Ltd., hinges; Plessey Co., Ltd., actuators, plugs and sockets; D. Powis and Co., Ltd., rivets; Renolds Chains, Ltd., chain assemblies; Reynolds Tube Co., Ltd., engine mounting rings, steel tube; R.M.R. Engineering Co., Ltd., A.G.S. parts; Rotax, Ltd., electrical equipment; Rotol, Ltd., accessory gearbox; Rubber Bonders, Ltd., anti-vibration mountings; L. A. Rumbold and Co., Ltd., furnishings and seats.

St. Helen's Cable and Rubber Co., Ltd., electric cables; Sangamo Weston, Ltd., electrical instruments; Saunders Valve Co., Ltd., non-return valves; Self Priming Pump and Engineering Co., Ltd., fuel booster pumps; Shell Mex and B.P., Ltd., petrol, oils and greases; Simmonds Aerocessories, Ltd., Pacitor fuel gauges, locknuts; Skefko Ball Bearing Co., Ltd., bearings; Smiths Aircraft Instruments, Ltd., instruments; Sperry Gyroscope Co., Ltd., autopilot and navigational equipment; Standard Telephones and Cables, Ltd., radio equipment; J. Stone and Co., Ltd., voltage regulators; Tecalemit, Ltd., filters; Teddington Controls, Ltd., valves and flasher units; Teleflex Products, Ltd., cable control boxes; Thermoplastics, Ltd., window assemblies; Thermotank, Ltd., punkah louvres; Thorn Electrical Industries, Ltd., navigational lamps; T.I. Aluminium Co., Ltd., aluminium alloy bar, sheet and tube; Titanine, Ltd., paints and varnishes; Triplex Safety Glass Industries, Ltd., windscreen panels; Ultra Electric Co., Ltd., inter-com. equipment; Varley Dry Accumulators, Ltd., batteries; Venner Accumulators, Ltd., emergency accumulators; Vokes, Ltd., cabin silencers and engine air filters; Whitehouse Industries, Ltd., locknuts; Wilkinsons Rubber Linatex, Ltd., Linatex sealing rings.

Proof before prophecy

It is not our business to debate the future, but to build it. Progress in the air is won, we believe, by ruthless concentration on the present task. Our first duty is to create aircraft engines which fulfil required functions under all conceivable conditions—engines such as the compact Double Mamba turbo-prop, now successfully serving the special needs of the anti-submarine Fairey Gannet in squadron service with the Royal Navy. Our responsibility then lies, as we see it, in the searching and systematic development of these proven types, in order that they may match the evolution of aircraft design with progressive yet predictable performance.

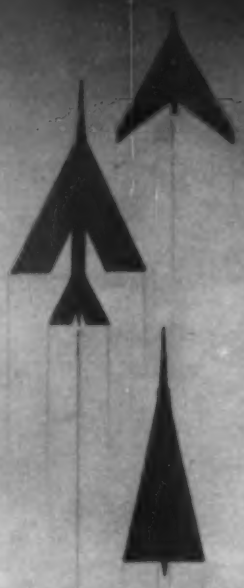


ARMSTRONG SIDDELEY AERO ENGINES

ARMSTRONG SIDDELEY, COVENTRY & BROCKWORTH

Members of the Hawker Siddeley Group

pioneer designers of the ejection seat



UNPARALLELED ACHIEVEMENTS

Squadron Leader J. F. Fifield, D.F.C., A.F.C., made aviation history when he successfully ejected from a Meteor aircraft at runway level during September and again the following month at an altitude of more than 40,000 feet.

Martin-Baker Fully Automatic Ejection Seats were used for both tests, proving yet again that these seats are undoubtedly the finest in the world of aviation.

NOTE TO AIRCREW:

The Seat used for the runway ejection was fitted with modified time release, not yet incorporated in Service equipment.

MARTIN-BAKER

THE OSTIV CONGRESS

Technical Accompaniment to the World Gliding Championships

THE international scientific and technical organization of the gliding movement (OSTIV) holds a biennial congress at the same time and place as the World Gliding Championships. Many delegates come especially to attend the congress, but others who are concerned in the championships as meteorologists, sailplane designers and even pilots and crews, are able to contribute papers and join in the discussions. The sixth congress of OSTIV was held at St. Yan, France, from July 6 to 13. Two halls were available in the village, half a mile from the airfield, and on several days papers on meteorology and technical matters were being presented simultaneously.

Meteorology. The meteorological contributions covered three main subjects—jet stream and squall lines, thermal convection, and atmospheric waves. In each section, papers were presented by professional meteorologists developing the theory of the phenomena and presenting observations by the usual tools of synoptic charts and soundings. The contributions of the glider pilots—often the only direct experimental evidence available—were invaluable. Dr. Paul MacCready, who became World Gliding Champion during the week and is a professional meteorologist as well as a pilot, presented a paper on "Research on the transport of freezing nuclei and on atmospheric turbulence by means of a sailplane."

Observations by amateur meteorologist-pilots were equally well received. Hanna Reitsch described a flight beneath a powerful squall-line in Germany, and Philip Wills his flight to 30,000ft in the atmospheric wave over Mount Cook in New Zealand. Betsy Woodward, of the U.S.A., holder of the world height record of over 40,000ft for women glider pilots, is also a meteorologist working at Imperial College, London. She described experimental sailplane flights made through cumulus clouds in tests to throw light on the structure of these clouds. Similar tests in the United States, in which powered aircraft (equipped with sensitive and very responsive thermometers and hygrometers) had been used, were described in a paper by Dr. Cunningham.

Dr. Joachim Küttner (U.S.A.) presented another film showing the work of the Sierra Wave Project in California. This magnificent enterprise, now concluded, has revealed the extent of the extreme turbulence in certain wave systems and the very large up- and down-motions in these waves. Flight traverses by B-29 and B-47 aircraft had shown vertical deflections of the air of more than 5,000ft. A pilot unappreciative of the situation might easily find a mountain top in his path in such conditions, and the air safety organizations have rightly publicized these findings. To the glider pilot, of course, this free power supply is welcome—provided that he knows enough to avoid the dangerous parts of the wave.

A description of a smaller project at St. Auban in the French Alps was given by M. Gerbier, of the French S.F.A.S.A. It was appropriate that several of the pilots competing in the World Championships reached heights of over ten thousand feet above St. Auban in these very waves—a happy marriage of theory and practice.

Technical. On the technical side, contributions covered a wide range. There were specialist papers on metal construction, boundary-layer suction, total-energy variometers (Frank Irving), short wave radio, and training methods in Britain (Ann Welch). Wider interest was aroused by papers on the development of certain sailplanes. By chance, the two speakers on this subject were Mr. Fred Slingsby, whose T.42 won the two-seater championship and whose Sky and Skylark 3 sailplanes flew so well in the single-seater class, and Messieurs Cayla and Cartier of Bréguet, who were responsible for the Bréguet 901, one of which was flown in the championships by Paul MacCready.

A joint session with the meteorologists was held to discuss the progress toward a stratospheric sailplane. Many sailplanes have now exceeded 40,000ft and have there found upcurrents of more than 1,000 ft/min. There is some evidence that upcurrents may be strong enough to sustain a glider at very much greater heights—in fact, the low wing-loading of the sailplane may enable it to exceed the present height record of powered aircraft. The next step is clearly a pressurized cabin, and several design studies have been made; at least one pressurized sailplane is under construction.

Technical Publications. The Congress papers will be published in due course. Most of the meteorological papers will appear in the specialist meteorological journals, although off-prints will be available from OSTIV. The technical papers have hitherto been printed and published in one volume by OSTIV. This process has taken about two years, and the papers read at Buxton at the fifth congress in 1954 have only recently become available (price 9s from the British Gliding Association).

In future, the technical papers are to be published in *Swiss Aero Review*, the official organ of OSTIV. Papers in French or German will appear in the general text, but there is also to be a monthly four-page insert called *OSTIV News*. This will contain the text of papers written in English and will also provide a regular newsletter from OSTIV. The editor is Betsy Woodward, Imperial College, London, S.W.7, and *OSTIV News* will present regular bibliographies and summaries of papers of interest to gliding published all over the world. OSTIV will eventually bind the off-prints to form a record of the congress.

Officers. The officers and board of the Organization were elected at St. Yan as follows: *President:* L. A. de Lange (Holland). *Vice-President:* Dr. W. Eichenberger (Switzerland). *Board:* M. Agésilas (France), Dipl. Ing. Boris Cijan (Yugoslavia), Wolf Hirth (Germany), Dr. W. B. Klemperer (U.S.A.), Alan Yates (Great Britain). The secretary is C. Slikkerveer (Holland) at Kanaalweg 3, The Hague, Holland.

Future World Gliding Championships. The Gliding Commission of the F.A.I., meeting at St. Yan during the World Championships, made some important decisions concerning the future organization of world gliding.

At present there are two championship categories, one for single-seaters and one for two-seaters. There were 45 and 13 sailplanes respectively in these classes this year. The Gliding Commission has decided to abolish the two-seater championship in future contests. Any multi-seater sailplanes entered, whether flown by one or more pilots, will have to compete on equal terms with the single-seaters. Although the two-seater is bigger and heavier and usually inferior in performance, there are compensations in having a second crew-member. Navigation, radio operation and the calculations needed for maximum performance can all be taken from the pilot so that he is able to concentrate on the flying.

There may, however, still be a second championship. The F.A.I. Gliding Commission asked OSTIV to recommend rules suitable to define a *Restricted Class* of sailplanes. The aim is to encourage the construction of sailplanes which are cheap and easy to operate. Many of the new sailplanes at St. Yan were extremely expensive in construction and were quite unsuitable for club or private owner operation. Nevertheless, excellent performances are possible with simpler designs, and the F.A.I. wishes to encourage their construction and entry to World Championships.

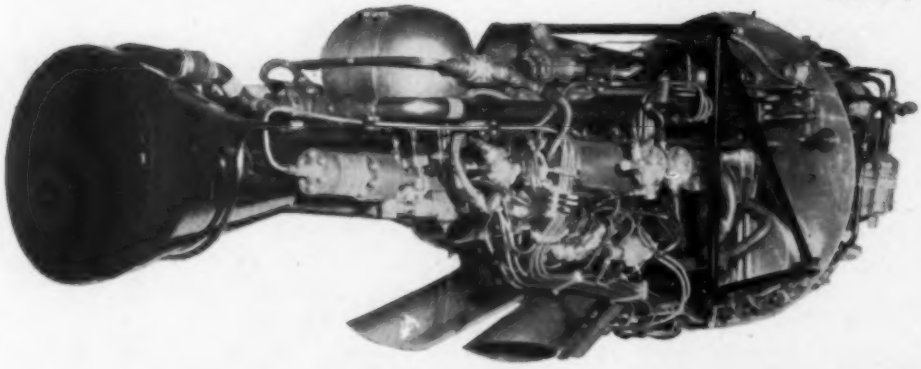
OSTIV organized a special meeting on this subject at St. Yan, and many smaller discussions between designers took place. As a result, the Board of OSTIV have sent to F.A.I. recommendations proposing a 15-metre class for single-seaters (18 metres for two-seaters). Flaps and certain other expensive aids would be prohibited. Clearly, any rules must be capable of being checked quickly, and OSTIV has avoided complicated limitations. Much will depend on the willingness of designers to act in accordance with the spirit of the proposal. In addition to success in the restricted-class championship, the designer would be eligible for the cup which the F.A.I. hope to award for the most meritorious design as selected by a jury.

We have got so used to 18-metre single-seaters and even larger two-seaters that some observers consider that top-class performances would not be possible in a restricted class. This view was undermined at St. Yan by the success of the British 18-metre T.42 in competition with several expensively exotic two-seaters, and by several brilliant flights by the pre-war 15-metre Meise-Olympia. The restricted class will add considerable interest to future World Gliding Championships.

A. H. Y.

NEW BRITISH STANDARDS

RECENTLY published British Standards include the following (obtainable at the prices shown from the B.S.I. Sales Branch, 2 Park Street, London, W.1): B.S. 2G 113, manifold pressure gauges for aircraft (2s); B.S. SP 115 to 117, three specifications for aircraft lubricating nipples of the hydraulic type (embodied in one document, 3s); B.S. 2A 113-114 and 2A 170, revised standards for aircraft bolts with mushroom heads and unified threads (2A 113-114, 4s each; 2A 170, 3s); B.S. A 173-5, three new standards for 100 per cent countersunk head steel bolts (unified threads) for aircraft (6s each); B.S. 2G 112, specification for air-driven directional gyroscope (3s); B.S. S500 and S510 to S523 (inclusive), relating to inspection and testing requirements for steel sheets and strips used in the manufacture of aircraft (S500, 7s 6d; others 2s); B.S. 2715, internal combustion engines incorporating a coupling flange, for use with rigid and flexible shaft couplings, or where interchangeability of mating flanges is necessary (2s 6d).



ARMSTRONG SIDDELEY SCREAMER

A Powerful Rocket Motor from Coventry

IT is a curious fact that, outside the U.S.A., only one company has any considerable background of experience with liquid-oxygen aircraft rocket motors. This company is Armstrong Siddeley Motors, Ltd., whose Rocket Division is based at Ansty, near Coventry. In the years following World War 2 their embryo rocket staff—under Mr. S. Allen, chief engineer—"got their feet wet" with a 2,000 lb-thrust unit named Snarler. This motor ran on liquid oxygen and methanol, the drive to the pumps being taken from an external source, such as the wheel-case of a turbojet. The Snarler was flight tested in 1950 and a full description appeared in our issue of August 6, 1954.

No production order was placed for the Snarler but the Ministry of Supply asked Armstrong Siddeley to develop a larger unit capable of meeting the requirements of future designs of supersonic fighter. The new project was given the name Screamer and development went ahead upon an engine incorporating its own pump drive, so that, if necessary, it could be used as the sole means of propulsion for an aircraft. From the outset the normal requirements for engines intended for piloted, aerobatic aircraft had to be met in full, and a further requirement was that the thrust of the Screamer should be variable over a wide range.

At the start of design in 1950 the Screamer was intended to give 4,000 lb thrust at sea level. The first work—which preceded the development contract—was concerned with an up-rated Snarler, using liquid oxygen and methanol fed by pumps driven from an external source of shaft power. The next step in development was to incorporate a gas generator and turbine to fulfil the latter function, thus making the unit self-contained. Following this step it was decided to redesign the motor to enable it to run on liquid oxygen and kerosine or wide-cut petrol; although seemingly unimportant from the design point of view, this actually required more development man-hours than did any other single design change, largely owing to the significantly increased flame-temperature. The first run with kerosine took place in 1951.

Shortly afterwards an aircraft application became foreseen. As is frequently the case when this occurs, the thrust requirements began to rise, first to 6,000 lb and then to 7,000 and 7,500 lb. At one period in the development the Screamer design specified two combustion chambers, the larger chamber being required only for periods of maximum thrust. By June 1952, however, the design was frozen with a single chamber which reduced the weight and base drag, more than counteracting the slight rise in cruising fuel consumption. The high design pressure in the combustion chamber is an aid to obtaining good specific fuel consumption at partial thrust and, at the high altitudes where such low thrust would be most probably required, the low atmospheric pressure assists in keeping the expansion efficiency at a high value. The Screamer chamber was designed with an expansion cone correct at full thrust at an ambient pressure of 6.67 lb/sq in, corresponding to about 20,000ft altitude. At minimum thrust the pressure corresponds to 68,000ft.

As the total technical and design staff at this time numbered between 20 and 25, the magnitude of the task of developing a motor of the calibre of the Screamer could be described as awesome. In order to attempt to quicken development and get a prototype Screamer into the air, it was decided to employ water as a third propellant. During the early years of Screamer development there was very little design knowledge of gas generators—for driving turbines—burning a mixture of liquid oxygen and hydrocarbon fuel, and the injection of a suitable amount of water (to form super-heated steam) resulted in a final flow of gas to drive the pump turbine more akin to that from high-test peroxide, albeit with some carbon dioxide present.

Because water was being carried for the gas generator, it was decided to use its excellent cooling properties in the combustion chamber jacket, the water then being injected into the combustion chamber as a third propellant. The advantages obtained in cooling were considered to outweigh the loss in specific impulse due to lowering the temperature of the combustion gas. In any case, this loss was only slight because of the effect of water in reducing the mean molecular weight of the exhaust gas.

It was envisaged that, shortly after the first flight, the water system would be deleted, and by the time the Screamer was cleared for flight at the end of last year, the gas generator had been operated with an excess of oxygen and the combustion chamber had been cooled by hydrocarbon fuel. Conversely, of course, the use of water increased the general circuit complexity by more than 50 per cent, and, since no restrictions were placed on the type of water employed, deep anodizing and chromate sealing was necessary to prevent corrosion of aluminium parts.

Particularly in the development of the pumps, valves and seals, the previous experience of the Snarler programme proved invaluable and, in fact, Snarler pumps were used as a starting point. All three pumps are designed to run at a maximum of about 20,000 r.p.m., at which speed the delivery pressure is 900 lb/sq in for the liquid oxygen and 850 lb/sq in for the water and hydrocarbon fuel. The liquid-oxygen pump has a five-vane impeller with a screw booster, in S.110 steel (unlike the Snarler pump, the impeller is not shrouded), running in a cast, stainless casing incorporating a vapour bleed valve similar to that on the Snarler.

Owing to the high rubbing speed, it was decided to employ a face seal of fluon-impregnated sintered bronze, 0.025in thick, on a steel backing, spring-loaded against a fixed Hecla washer ground optically flat within one Newton ring. Whereas in the Snarler one of the bearings was unlubricated, all bearings in the Screamer liquid-oxygen pump are lubricated by E.E.L.3 synthetic oil circulated from a pump on the gearbox, with precautions to prevent it from coming into contact with the liquid oxygen. Special Durestos sleeves and washers are employed to insulate the coldest portions of the pump from the remainder. The fuel and water pumps both employ similar open, five-vane impellers in aluminium-alloy volute casings with a stationary carbon-faced seal and bellows. Pump development was largely done with electrically driven rigs pumping water.

Early development of the turbine was done at Ansty's steam plant used for gas-turbine research. Initially much effort was expended upon high-speed rotors resembling sophisticated Pelton wheels, but the final design is a more conventional axial-flow impulse turbine of the supersonic Laval type. Owing to the high blade loads the design was more arduous than for corresponding gas turbines, the gas velocity being about 4,000 ft/sec (at 625 deg C) and the peripheral speed of the turbine rotor being 1,100 ft/sec. The final design employs a Rex 448 disc (of about 13in diameter) broached to receive the fir-tree roots of 43 1.75in Nimonic 80 blades. At 20,000 r.p.m. this wheel delivers some 350 s.h.p. It drives a gearbox with 25-deg pressure-angle 10 d.p. teeth loaded at 1,000 lb per inch of face-width. On the box are mounted pumps for the three propellants, together with scavenge and pressure pumps for the E.E.L.3 oil, a tachometer/generator and, should the application require them, a pair of

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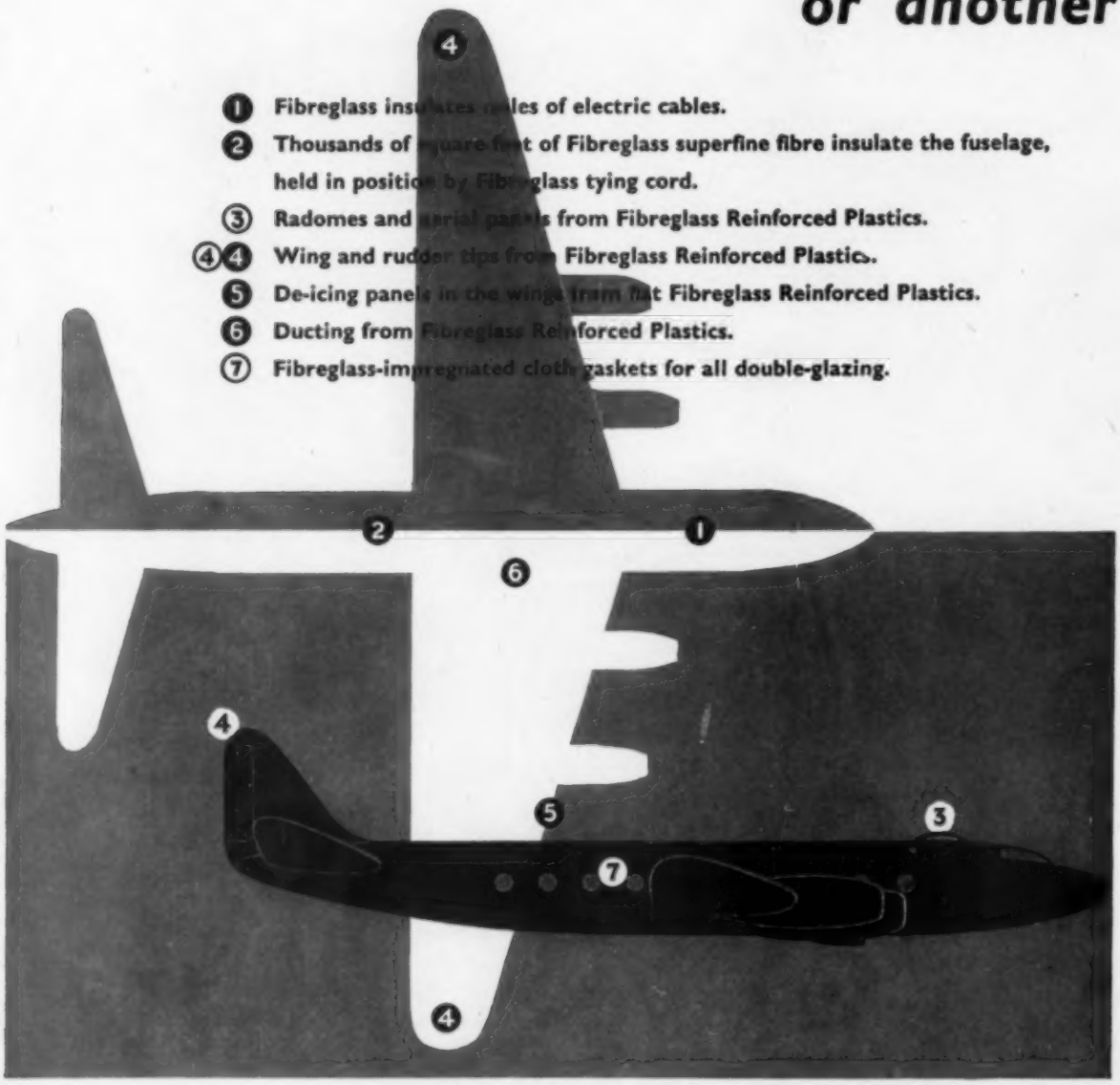
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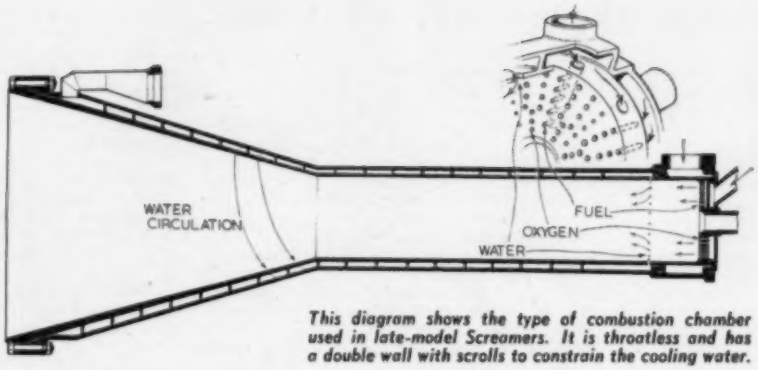
ARMSTRONG SIDDELEY SCREAMER...

Dowty Vardel hydraulic pumps. The oil circuit includes a heat exchanger cooled by the hydrocarbon fuel.

Gas to drive the turbine is supplied by a gas generator upon which many development man-hours were expended, largely in converting this unit from liquid-oxygen/methanol to liquid-oxygen/hydrocarbon fuel. In its essentials it resembles a miniature combustion chamber. At its head is an igniter body, forming a throatless chamber of 0.375in diameter. On either side of the igniter is mounted a high-frequency plug, the electrode of each being hollow and terminating at a 0.02in nozzle through which fuel is sprayed to form an impingement fan in the centre of the igniter. Liquid oxygen is sprayed from a 0.07in central hole in the head, so forming an oxygen-rich mixture capable of being easily ignited by the high-frequency discharge from the plug-body to the electrode.



This diagram shows the type of combustion chamber used in late-model Screamers. It is throatless and has a double wall with scrolls to constrain the cooling water.

The resultant jet of flame escapes through the water-cooled igniter body into a cup at the head of the gas generator proper. Here the flame meets liquid oxygen injected through two tangential swirl holes and fuel from three swirl injectors, forming a fairly oxygen-rich mixture which burns in the main body of the generator. An accompanying diagram shows the flow of water through the cooling scrolls in the chamber walls and also clarifies the method by which water is injected at the exit from the chamber. The resulting gas-flow has been found not to impair turbine life and to eliminate flame or smoke from the exhaust; furthermore, in spite of the quenching with water, no carbon is formed. Injection of water reduces the gas temperature to 625 deg C, the overall mass flow being about 2 lb/sec. The gas duct feeds three nozzles spaced around 120 deg of the turbine casing. From the turbine the gas is exhausted through twin ducts, *via* a snail-shell exhaust volute.

It is in the combustion chamber that the Screamer shows particularly marked departure from previous practice. Originally the work was centred upon orthodox throated chambers but it was soon found that good results could be obtained from a throatless chamber which, provided adequate performance can be obtained, is the optimum for low weight and good cooling. Theoretically the specific impulse is slightly reduced (compared with a throated chamber) owing to the fact that the heat is added to a rapidly moving gas stream. Various forms of chamber were run on liquid-oxygen and kerosine in 1951 and 1952 and the throatless chamber was the pattern which posed the fewest problems. The initial chambers were rated at 4,000 lb thrust and were fed from electrically driven pumps. Later, scaled-up chambers of 8,000 lb thrust were successfully tested, this thrust being first reached in September 1954.

Many variations were studied, with a view to determining the optimum method of injection of the water. One typical pattern of Screamer chamber, which is shown in the large drawing, accepts the water at the nozzle end; the water then passes round a cooling scroll in the divergent portion of chamber and back along the parallel section to a row of holes at the head of the chamber, through which it is injected to form a cooling film along the inner wall of the liner. In some designs of chamber axial coolant passages were formed using soft iron wire stretched along the divergent portion of nozzle.

Yet another type of chamber had five separate stages of water injection at various axial positions some 2-3in apart, fed with water from four external water pipes. Finally it was decided to inject all the water at the head of the chamber, with reverse flow through the double walls from an inlet at the nozzle end. Development was conducted with tubular slave chambers (without a divergent portion) machined from steel bar. To these were bolted flat back-plates drilled with radial or concentric rows of injection holes for the liquid-oxygen and hydrocarbon fuel. The final design of Screamer injector has like-on-like impingement jets in the centre and parallel (non-impingement) shower-head injectors around the outer portions.

At various stages in development the Screamer chamber was made in two portions bolted together at the junction of the parallel and divergent sections. In all designs the inner shell and outer case are made of S.21 mild steel, which is readily welded and has good thermal conductivity. The inner shell was hard-chrome-plated to resist erosion and other parts cadmium-plated to prevent rusting. Production chambers would have been tubular forgings but the development chambers were machined from solid. The back-plates in the Screamers so far built have also been machined from solid, the material being S.110 steel.

The starting and control system of the Screamer is relatively complex. For this reason no attempt is made here to describe the complete system in detail but the following is a full outline of the manner in which the motor is started and sustained.

Prior to firing, the three propellant feed valves are opened by energizing the suction-valve solenoid. This allows the propellants to flow from the main airframe tanks through filling valves to the starting tanks, and also to fill the main engine lines up to the stop and by-pass valves. One starting tank is provided for each of the three propellants, their purpose being to run the gas turbine up to speed during the starting cycle. The liquid-oxygen starting tank is a tubular steel cylinder containing a free-floating steel piston fitted with two Duaflex rings. Like the other starting tanks it is pressurized to 450 lb/sq in from a 3,000 lb/sq in nitrogen bottle, and it has an excess capacity in case the gas generator should be slow in starting. The tank automatically refills after each start, since it is connected to the pump suction and the head of liquid oxygen from the airframe tank is sufficient to refill the starting tank by pushing back the floating piston to its starting position. The fuel and water starting tanks are likewise machined from solid steel with an interior polished to a very high surface finish so that the synthetic rubber diaphragm within each tank shall not stick to the inner wall. At each end is a perforated plate, shown clearly in the large drawing, to prevent the diaphragm from being blown out of the tank.

Vapour formed by the liquid oxygen boiling in the warm pipes is released through priming valves on the starting tank and oxygen pump and also through by-passes from the valves associated with the gas generator and combustion chamber. Air trapped in the water and fuel lines can be bled off at suitable points. The Screamer starting-cycle is initiated by energizing the starting solenoid which allows nitrogen to open two paralleled valves which admit nitrogen pressure to the three starting tanks. At the same time nitrogen is used to purge various portions of the engine. From the starting tank the liquid oxygen is piped first to the stop and by-pass valve and igniter stop valve on the gas generator; fuel and water are each fed to the gas-generator and igniter valves and, *via* a pressure-balance valve, to the gas generator mixing section. The pressure of the water injected into the gas generator opens an air valve which allows nitrogen to open the main oxygen and fuel igniter stop valves; the combustible mixture then flows into the gas-generator igniter where it is immediately lit by the high-frequency plugs.

Should the igniter pressure not rise to its normal value within two seconds dangerous accumulations of propellants are prevented by a delay switch. Assuming normal ignition the rising igniter pressure opens a valve to admit the main gas-generator propellants, and also operates a switch which breaks the two-second delay circuit and at the same time makes the high-frequency circuit for the main combustion-chamber spark. A nitrogen-operated switch effects the change-over in ignition from the gas generator to the main combustion chamber.

Gas from the gas generator accelerates the turbine so that the three pumps feed propellants back to the main tanks *via* the by-pass lines from the three main stop and by-pass valves. In the same way as for the gas generator, the main flows of fuel and water are fed to the main combustion chamber through a pressure-balance valve (39-41 in the key). Water pressure immediately downstream of the pump energizes a switch and solenoid circuit, allowing nitrogen to admit igniter fuel and oxygen to the main chamber. Propellants fed to the main-chamber igniter are lit by sparks from the high frequency plugs and the resulting build-up of pressure opens another valve, allowing nitrogen to operate the main water stop and by-pass valve and also a pressure switch which breaks the delay circuit and switches off the plugs—just as in the circuits associated with the gas generator. Water pressure downstream of the main valve operates the main liquid-oxygen valves and the resulting oxygen pressure then operates the fuel valve, the propellants being fed in this sequence to the combustion chamber.

ARMSTRONG SIDDELEY SCREAMER...

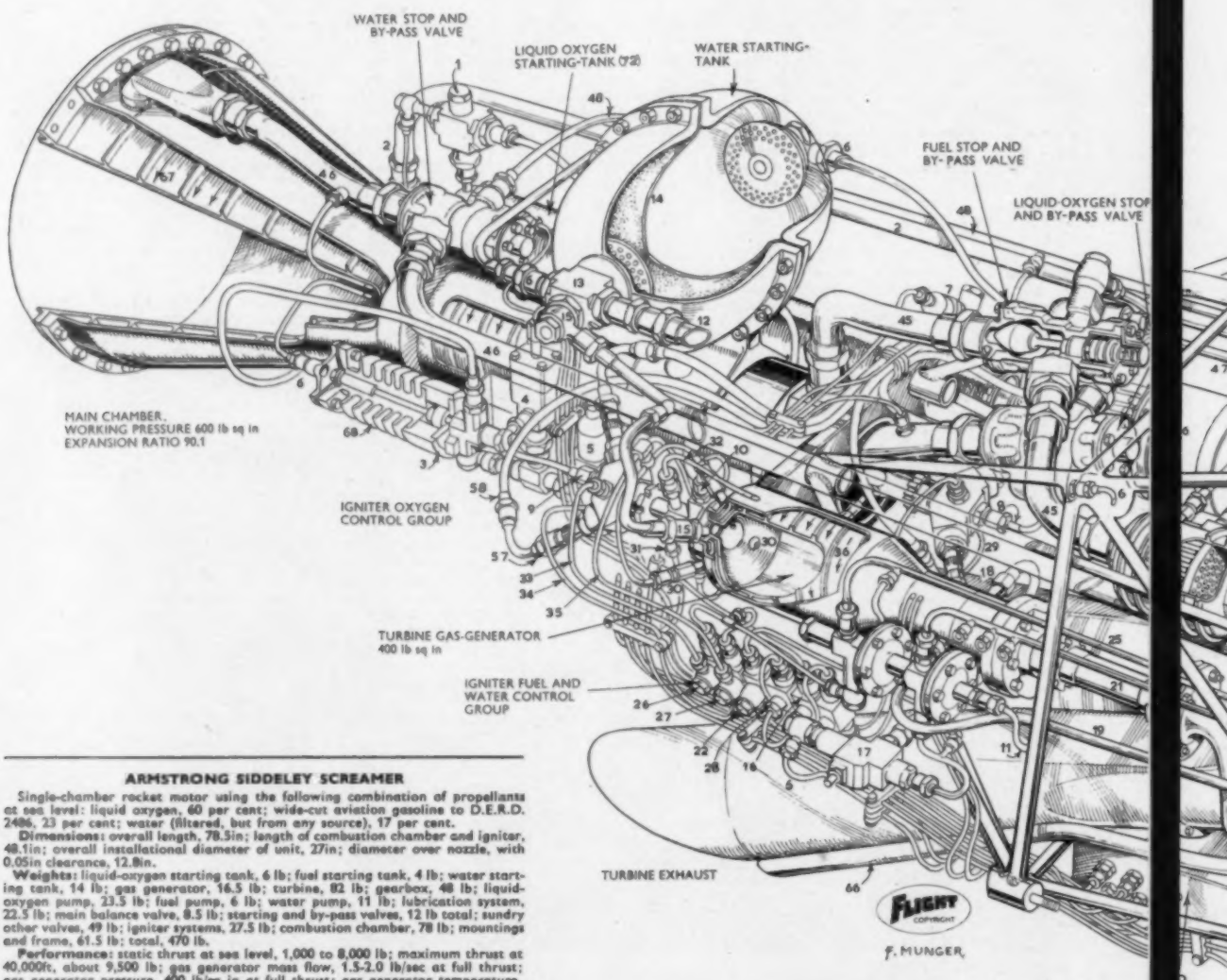
As already described, the oxygen and fuel are fed to the back-plate manifolds and the water through the cooling-jacket to the injection holes around the head of the chamber.

When the main chamber has lit, the combustion pressure de-energizes the change-over solenoid, which feeds the starting tanks and opens the filling valves so that the starting tanks can be recharged. The entire sequence from closing the starting switch to lighting the main chamber is complete within two-three sec. Propellants are fed from directly downstream of the pumps into the gas-generator lines; in the case of water and fuel, check valves are inserted, and the liquid oxygen passes through a change-over check valve and a remotely operated flow-control. The latter is a spring-loaded reducing valve which regulates turbine speed—and hence the thrust of the motor—by reducing the gas-generator oxygen pressure and hence also the pressures of fuel and water. To provide a variable thrust datum the loading of the spring can be altered by the pilot. A safety switch shuts down the engine in the event of overspeeding of the turbine.

The complete Screamer is made up into a compact motor based on a framework of welded T.45 steel tubes. Thrust is transmitted to this frame through three bolts on a flange at the head-end of the chamber; in the centre of the unit is a main frame with four pick-up points bolted to the airframe. Most of the piping is made of austenitic steel.

Of the various dates associated with the development of the Screamer, the most important is probably March 1954, when the various components were first run together as an integral aircraft powerplant. In September of that year a development motor was first run at the ASSc.1-2 rating of 8,000 lb thrust. Although the first target for flight-clearance—in December 1955—was 2,000 to 4,000 lb, during the build and preparation for such clearance another Screamer logged a total of three hours' running at 8,000 lb and over. It was, in fact, found that operation at 8,000 lb was just as reliable as at lower ratings.

(*Concluded on page 164*)


WATER STOP AND BY-PASS VALVE
LIQUID OXYGEN STARTING-TANK (72)
WATER STARTING-TANK
FUEL STOP AND BY-PASS VALVE
LIQUID-OXYGEN STOP AND BY-PASS VALVE
MAIN CHAMBER. WORKING PRESSURE 600 lb sq in EXPANSION RATIO 90.1
IGNITER OXYGEN CONTROL GROUP
TURBINE GAS-GENERATOR 400 lb sq in
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ARMSTRONG SIDDELEY SCREAMER

Single-chamber rocket motor using the following combination of propellants at sea level: liquid oxygen, 60 per cent; wide-cut aviation gasoline to D.E.R.D. 2486, 23 per cent; water (filtered, but from any source), 17 per cent.

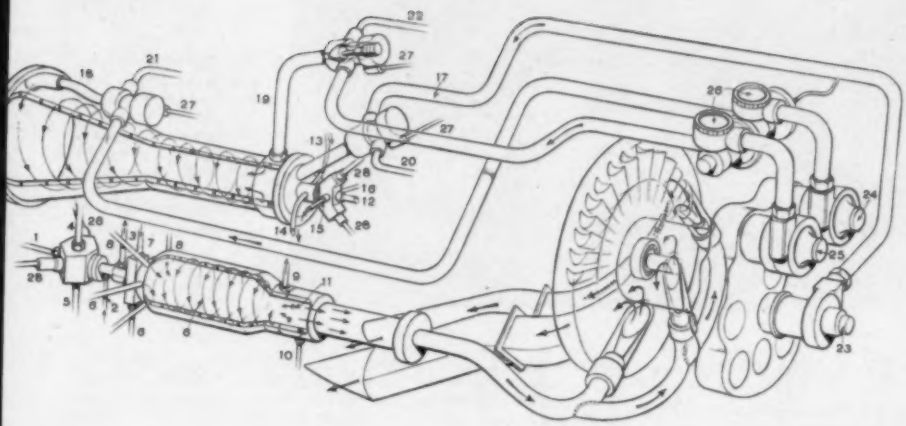
Dimensions: overall length, 78.5in; length of combustion chamber and igniter, 48.1in; overall installational diameter of unit, 27in; diameter over nozzle, with 0.05in clearance, 12.8in.

Weights: liquid-oxygen starting tank, 6 lb; fuel starting tank, 4 lb; water starting tank, 14 lb; gas generator, 16.5 lb; turbine, 82 lb; gearbox, 48 lb; liquid-oxygen pump, 23.5 lb; fuel pump, 6 lb; water pump, 11 lb; lubrication system, 22.5 lb; main balance valve, 8.5 lb; starting and by-pass valves, 12 lb total; sundry other valves, 49 lb; igniter systems, 27.5 lb; combustion chamber, 78 lb; mountings and frame, 61.5 lb; total, 470 lb.

Performance: static thrust at sea level, 1,000 to 8,000 lb; maximum thrust at 40,000ft, about 9,500 lb; gas generator mass flow, 1.5-2.0 lb/sec at full thrust; gas generator pressure, 400 lb/sq in at full thrust; gas generator temperature, 625 deg C; combustion chamber pressure, 600 lb/sq in at full thrust; combustion chamber temperature, 3,200 deg C; combustion chamber mass flow, 36.84 lb/sec at full thrust; specific impulse at sea level, 217 (206 overall); jet velocity, 7,000ft/sec; characteristic length of chamber, 14 in.

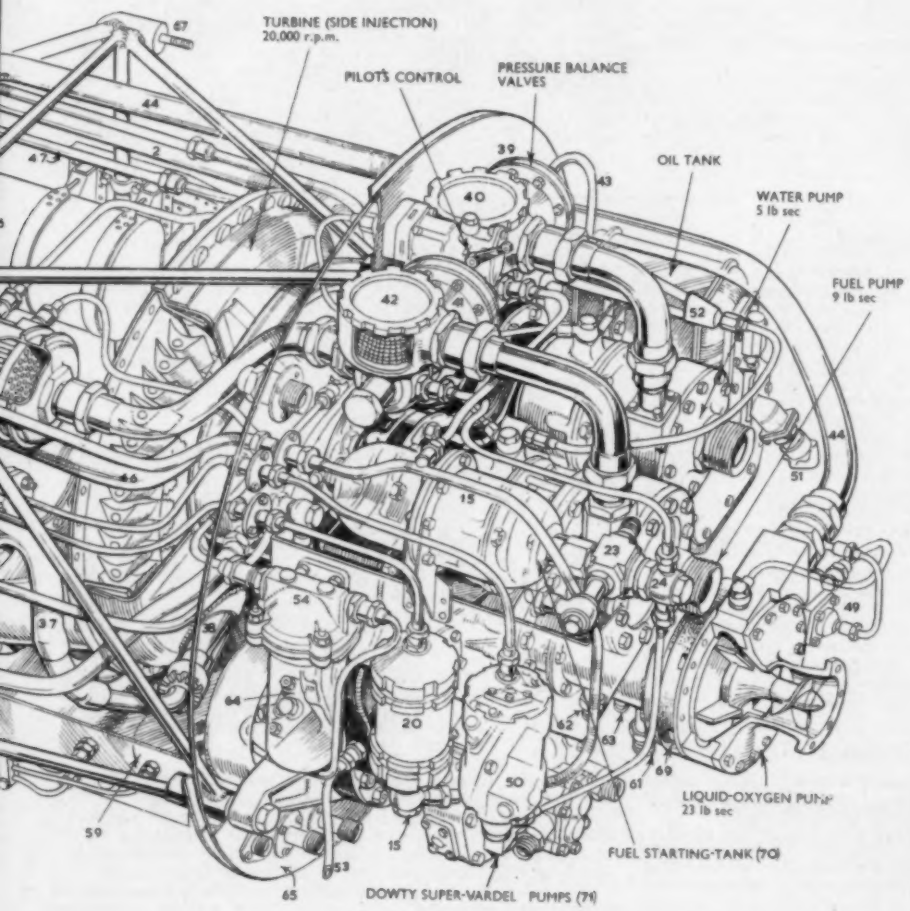
KEY TO MAIN DRAWING

1 Liquid-oxygen starting-tank priming valve.
2 Liquid-oxygen starting-tank main filling.
3 Liquid-oxygen control valve, starting tank to igniters.
4 Gas-generator oxygen control valve.
5 Main-chamber igniter oxygen control valve.
6 Nitrogen pressure for valve operation.
7 Main-chamber igniter oxygen control valve.
8 Oxygen delivery to main-chamber igniter.
9 Oxygen delivery to gas-generator igniter.
10 Oxygen delivery to gas chamber (main).
11 Oxygen pressure controlling gas-generator flow pressure-balance valves.
12 Water starting-tank main filling.
13 Water starting-tank filling and delivery valve.
14 Rubber diaphragm (water-expelled position).
15 Water delivery.
16 Main-chamber igniter water control.
17 Gas-generator water (diluent flow into gas stream) control.
18 Gas-generator water (diluent flow) delivery.
19 Gas-generator cooling-water return.
20 Filter in gas-generator water system.
21 Water delivery to gas-generator pressure-control valve.



1 Gas-generator igniter oxygen.
2 Gas-generator igniter water in.
3 Gas-generator igniter water out.
4 Gas-generator igniter fuel.
5 Gas pressure.
6 Main gas-generator oxygen.
7 Cooling water in.
8 Fuel nozzles.
9 Cooling water out.
10 Gas-generator diluent water in.
11 Diluent-water injection into chamber.
12 Main-chamber igniter oxygen.
13 Igniter water in.
14 Igniter water out.
15 Main-chamber igniter fuel.
16 Gas pressure.
17 Main-chamber liquid oxygen.
18 Main-chamber water.
19 Main-chamber fuel.
20 Liquid-oxygen by-pass.
21 Water by-pass.
22 Fuel by-pass.
23 Liquid-oxygen pump.
24 Water pump.
25 Fuel pump.
26 Main flow-control pressure-balance valves.
27 Nitrogen pressure to control system.
28 Igniter plugs.

The large drawing below shows an "ultimate" form of Screamer, which does not, in fact, exactly correspond with any actually built. The flows of the various propellants are clarified in the diagram above.



KEY TO MAIN DRAWING (CONTD.)

22 Igniter cooling-water control.
23 Fuel starting-tank main filling and delivery valve.
24 Fuel starting-tank.
25 Fuel delivery via filter (50) to gas-generator pressure control.
26 Igniter fuel control.
27 Main gas-generator fuel control.
28 Main-chamber igniter fuel control.
29 Fuel delivery to main-chamber igniter.
30 Gas-generator fuel spray nozzle (3).
31 Cooling-water delivery to igniter body.
32 Igniter cooling-water return.
33 Igniter fuel delivery.
34 Gas pressure tapping.
35 Fuel delivery to gas-generator spray nozzles (30).
36 Cooling water circulating round chamber; delivery via (15), return via (19).
37 Combustion gas from gas generator to turbine.
38 Turbine injector nozzles (3).
39 Main water flow-control pressure-balance valve.
40 Strainer for (39).
41 Main fuel-flow control pressure-balance valve.
42 Strainer for (41).
43 Liquid-oxygen pump output-pressure to control (39) and (41).
44 Main liquid-oxygen delivery.
45 Main fuel delivery.
46 Main water delivery (after cooling circulation) (67) injected into combustion chamber.
47 Fuel by-pass return.
48 Water by-pass return.
49 Liquid-oxygen pump vapour bleed-valve.
50 Fuel filter in delivery line to gas-generator system.
51 Oil tank pressure-filling valve.
52 Oil tank and wheel-case breather system.
53 Wheel-case overboard vent.
54 Oil filter.
55 Fuel-cooled oil cooler.
56 High-frequency ignition generator (pressurized).
57 High-frequency igniter-plugs.
58 Pressurized ignition leads (7 lb/sq in).
59 Nitrogen reservoir (450 lb/sq in).
60 Tray containing nitrogen control valves.
61 Liquid-oxygen pump oxygen drain.
62 Liquid-oxygen pump bearing-oil drain.
63 Liquid-oxygen pump bearing-seal air-vent.
64 Oil pressure pump.
65 Firewall.
66 Turbine bearing-case vent.
67 Water cooling circulation, finally injecting into combustion chamber.
68 Heating fins to raise valve-body temperature.
69 Durestos insert to isolate bearing section from low temperature of liquid oxygen.
70 Same construction and operation as water starting tank.
71 Two, for aircraft services.
72 Piston recuperator type.

The Screamer was installed for flight testing beneath a Meteor 8 at Bitteswell. In this photograph the motor is uncowled, revealing the bulkheads and firewalls; the jettisonable liquid-oxygen tank is immediately ahead.

ARMSTRONG SIDDELEY SCREAMER...

Flight clearance involved about 90 minutes operation—without aid or servicing—consisting of 92 firings in the course of which such eventualities as running the tanks dry and simulating failure of various pneumatic and electrical circuits were investigated. The flight-clearance rating was ASSc.2-1 and a Screamer (Serial 103) was prepared for flight development in a Meteor 8 airframe (VZ 517). The motor was mounted under the belly, the chamber being angled downwards through 10 deg and the underside of the rear fuselage skinned with stainless steel separated from the original ventral surface by a 0.5in air-gap. Considerable redesign was necessary to accommodate the fuel and water tanks in the fuselage, and the liquid oxygen was accommodated in a complex design of double-bubble tank mounted immediately forward of the motor itself and neatly faired in to form a long streamlined nacelle. To guard against the possibility of having to make a wheels-up landing on the liquid-oxygen tank, the latter was arranged to be jettisonable in emergency.

Where possible Armstrong Siddeley designed the Screamer to have a very long life, and the overhaul life, including such replaceable items as seals, would probably have been tentatively fixed at 25 hr. Up to the point of flight-clearance last December development Screamers had completed over 1,350 firings, totalling some 36 hours' actual running time. Altogether this unit can be said to be representative of modern and efficient practice in the development of liquid-oxygen rockets for permanent installation in piloted aircraft. It is one of very few such units ever to have been developed to so advanced a degree.

CONTRIBUTORS TO THE SCREAMER

Automotive Products Co., Ltd.: Purolator paper filters for gas-generator fuel and water; British Piston Ring Co., Ltd. (Brico): small piston rings; Bristol Aircraft, Ltd.: 3,000 lb/sq in nitrogen bottles (development taken over from Messier); Dowty: oil filters (and Vardel hydraulic pumps); Dunlop Rubber Co., Ltd.: many items of pneumatic equipment; Flexo-Plywood Industries, Ltd. (Cork Manufacturing Co., Ltd.): Durestos laminations for liquid-oxygen pump; Glacier Metal Co., Ltd.: governor-servo and alternate flow-control unit; Hoffman Manufacturing Co., Ltd.: bearings; A. Kershaw and Sons: optically flat surfaces (e.g., on Hecla-washer face); K.L.G. Sparking Plugs, Ltd.: igniter plugs; J. W. Lawrence, Ltd.: fuel/oil heat-exchanger; Lodge Plugs, Ltd.: igniter plugs; Morgan Crucible Co., Ltd.: carbon seals; Plessey Co., Ltd.: high-frequency spark generator and ignition unit; Precision Rubbers, Ltd.: rubber diaphragms and seals; R.E. Components, Ltd.: rubber components, including gaskets for resisting E.E.L.3 oil; Ransome and Marles Bearing Co., Ltd.: bearings; Self-priming Pump and Engineering Co., Ltd.: finished starting tanks; Smiths Group: tachometer generator; Teddington Aircraft Controls, Ltd.: solenoid valves and pressure switches; Wellworthy, Ltd.: Duaflex rings.

LOSING GROUND

A U.S. Senate Armed Services sub-committee has been trying to determine if the U.S.A.F. has lost air superiority to the Russians. Testifying before the committee, General Weyland, Commander of U.S.A.F. Tactical Air Command, is reported to have stated that a shortage of skilled personnel had become so serious that even if the Command received more of the latest fighters it would not be able to maintain them. One-third of T.A.C.'s new fighters were already grounded and pilots could fly only about half of the necessary training time because of maintenance deficiencies. General Weyland also claimed that if the United States had had an adequate tactical air force in 1950, the Korean War might not have started.

The U.S. Senate Appropriations Committee voted a further $1,160m (about £414,285,000) for U.S.A.F. expansion. Of this sum about $800m (about £285,700,000) would be devoted to speeding up production of such aircraft as the Boeing B-52. This production build-up is expected to take about a year to complete.

On the other hand, General Curtis Lemay, Commander of U.S.A.F. Strategic Air Command, is reported to have recommended a reduction in air force strength to a level which could be supported without Government emergency measures. The present budget allocated for 1957 was, however, inadequate, and he recommended that a specific number of B-52s should be built.

DATA ON NON-FERROUS METALS

"Metal Industry Handbook and Directory." Published for "Metal Industry" by Iliffe and Sons, Ltd., Dorset House, Stamford Street, London, S.E.1. Price 15s (by post, 16s 3d).

NOW in its 45th year of publication, this is a comprehensive reference work for all engaged in or connected with the non-ferrous metal industries. It contains up-to-date information on the properties of newer as well as the more familiar materials, and an extensive section is devoted to summaries of aircraft, D.T.D. and Admiralty specifications.

The handbook also includes a section on the chief metal-finishing processes and data on rod, bar, sheet and strip products. A new feature in this year's edition is a tabular section on the weight of titanium alloys in sheet, rod and tube.

AUTOMATIC LIFE-JACKET INFLATION

A DEVICE which will automatically trigger the CO_2 container on an aircrew life-jacket within 15 seconds of immersion has been developed by North American Aviation, Inc., International Airport, Los Angeles 45, California. The device, which weighs only 5 oz, consists of a cap, a piston, a spring-loaded plunger, a soft rubber flapper valve and an effervescent pill about the size of an Alka-Seltzer tablet and compounded of 60 per cent tartaric acid and 40 per cent sodium bicarbonate.

The North American automatic inflation device attached to a standard American life-jacket cylinder.

When the device is immersed, water enters through the metal cap and opens the rubber valve. It then reaches the tablet, dissolving it and evolving gas. The gas pressure closes the valve again and forces down a piston at the other end of the chamber. This in turn releases the spring-loaded plunger, which strikes the normal bottle-operating lever, resulting in inflation of the life-jacket.

Rainfall, heavy dew or accumulated moisture such as might be encountered in normal operating conditions will not trigger the device, since it will only operate under the pressure of a bulk of water. The North American company has applied for a patent.

Development was begun after the company's test pilot, George Smith, had landed in the water unconscious after ejecting at supersonic speed last year. By chance he was picked up, his life jacket not inflated, only 50 seconds after entering the water.

Heralds *would improve the picture*

for Continental holidaymakers

When he went on his own, a holiday in Europe could be a fairly cheap affair, especially as he was prepared to rough it where necessary.

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Air transport is already showing how it can give the complete answer. But the service is a very specialised one. It requires extremely economical airliners with a good standard of comfort. They must be able to deliver passengers on the doorstep—not at a mainline airport miles from the address on the luggage labels.

Heralds will be able to do this job better than any other aircraft. They will be robust, comfortable and very cheap to operate.

They will be able to use the smaller airfields on both sides of the Channel and thus serve those who only need them as airborne ferry-boats to the nearer French beaches. They will also have the speed, range and pressurised comfort to provide a cheap and practical service to holiday places all over Europe.

for 9 *good reasons*

- **Safety: four-engined assurance with full load.**
- **Reliability: strongly and simply built for long life and easy maintenance.**
- **Performance: meets world-wide flight requirements with a clear margin in hand.**
- **Payload: carries 44 passengers and their luggage.**
- **Economy: costs less than 1¾d. a passenger-mile to run.**
- **Small airfields: can take-off with full payload from 1,000-yard unpaved landing-strips up to 5,000 feet.**
- **Cruising speed: 221 m.p.h.**
- **Pressurisation: efficient and comfortable travel up to 20,000 ft.**
- **High wing: easy loading and a good view for passengers.**

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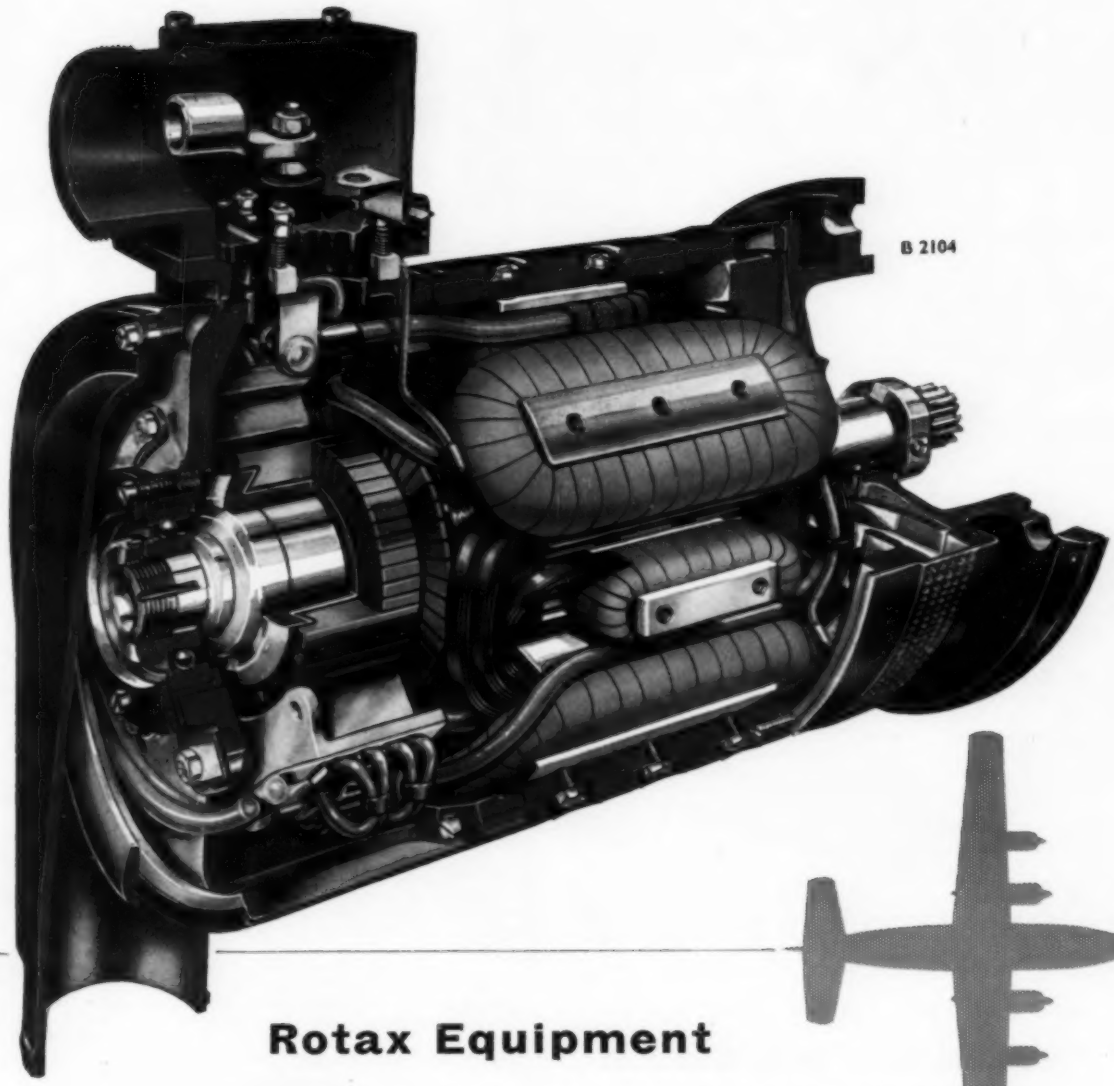

B 2104

Rotax Equipment Specified for 'The Herald'

THIS ROTAX GENERATOR is from the same series as that fitted to The Herald, which has also other Rotax equipment, including starters, actuators and switchgear. This piece of Rotax equipment is typical of the progress made by Rotax in the design and production of lighter, more efficient, more powerful generators, suitable for all types of aircraft under all operating conditions.

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GOODYEAR
AVIATION
PRODUCTS

HERALDS FITTED WITH GOODYEAR TYRES, WHEELS AND BRAKES AS STANDARD EQUIPMENT

Once again, Goodyear has been chosen as standard equipment. This time for the new 'Heralds', being built by Handley Page.

They have been designed to operate from large and small airfields, even those with a poor surface, and to be readily adaptable for passenger (a maximum of 44) or freight carrying, or to be able to carry both. Of vital importance to this all-round service will be the efficiency and durability of the aircraft equipment. That's why Handley Page have chosen Goodyear Disc Brakes with their hydraulic control gear and Goodyear anti-skid system, as well as Goodyear wheels and tyres.

This type of equipment has been proved in service to be thoroughly reliable and to operate efficiently at low maintenance cost. It is because of this proved performance that more aircraft the world over land on Goodyear tyres, tubes, wheels and brakes than on any other kind.

Wheel unit supplied by Goodyear for the Handley Page Herald.

THE GOODYEAR TYRE & RUBBER CO. (GT. BRITAIN) LTD., AVIATION DIVISION, WOLVERHAMPTON & WALLASEY

The Sycamore about to land on the sea shore at Birthday Creek on the west coast of Tasmania, about 40 miles south-west of Queenstown.

SYCAMORE in TASMANIA

New View for Old Prospectors

NEGLECTED copper mining claims staked out half a century ago by prospectors working on foot through the mountains of Western Tasmania have been sought out and surveyed by a Bristol Sycamore helicopter of Australian National Airways, flying on charter to a copper mine company.

This is one of a wide variety of tasks undertaken by the Sycamore during recent charter operations in Western Tasmania, an area still largely unmapped. Flying the aircraft on these operations were Captain Max Holyman, A.N.A.'s chief helicopter pilot, and Bristol test pilot Peter Moore, who visited Tasmania to give advice and help to A.N.A. during the Bristol helicopter's introduction to service.

The old mining claims were located by the Sycamore for the Mount Lyell Mining and Railway Company, one of the biggest copper mining organizations in Australasia. The company was following up the stories of old prospectors about "strikes" they had made many years ago, and the Sycamore's job was to fly surveyors over the old claims to determine whether there was a rich enough mineral lode to be worth exploitation. They were aided in their search by the use of a scintillometer—an instrument similar in principle to the Geiger counter and used for magnetic surveys of mineral deposits.

"On one occasion," said Peter Moore, "I flew on one of these prospecting trips with a couple of surveyors of the mining company and an old prospector of 75 who was a casual employee of the company. The bush prospector sat beside me and directed us entirely by memory of local features, following more or less the routes he had taken on foot many years before. In this way, he took us direct to a spot where he had started working a claim 45 years earlier."

The country over which the Sycamore was operating is completely without roads and railways, thickly forested and with mountains rising to perhaps 4,000 or 5,000ft. There are many "ghost" towns—mining settlements which have sprung up and been abandoned within the last 60 years.

The impenetrability of the country was strikingly demonstrated when Moore flew two mining engineers into the bush to carry out a survey. It was arranged that he should put them down, with their canoe, on the bank of a river, but the two men decided to explore a little farther afield and, after the canoe had been landed, asked to be put down about a quarter of a mile from the river. When the helicopter returned to pick them up, Peter Moore found that it had taken them half a day to cut their way back to the canoe, little more than 400 yd away.

One intriguing reaction of the "pick and shovel" prospectors to the introduction of the Sycamore into prospecting was that of a prospector named Harry. Harry chartered the Bristol helicopter for about five hours, simply to fly into the south-western area of Tasmania and stake out a claim on a lode he had discovered long before but had never officially registered.

A.N.A.'s Sycamore also undertook operations for the Tasmanian Hydro-electric Commission, for which Sycamores of the Royal Australian Navy last year carried out a number of survey and supply flights. Operating with a school playground as base, the helicopter took Hydro-electric Commission surveyors into the interior to make preliminary investigations of possible dam sites, landing on shingle beds at the sides of rivers, on tops of mountains, or on patches of button grass. On some flights the aircraft carried Government surveyors, who are mapping the area in detail.

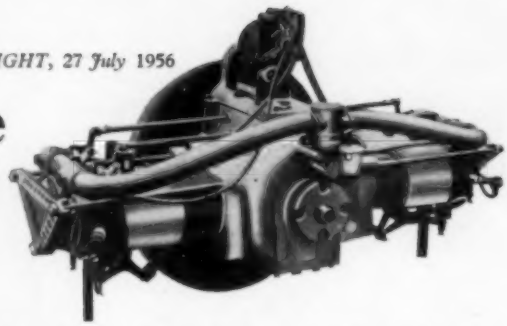
The Sycamore, which averaged five or six hours' operation a day, also delivered telegraph poles and insulators to the Hydro-electric Commission's grid lines, running across bush country. The telegraph poles were 12ft in length and weighed about 100 lb apiece; six or seven were carried athwart the fuselage on each flight.

On another operation for the Commission, the Bristol helicopter carried into the mountains a prefabricated hut, with log floor and insulated galvanized iron walls and roof, for the use of a construction crew.

One of the last tasks undertaken by Peter Moore before his return to England was a demonstration for the Mount Lyell mining company, in which he lifted part of a mine railway truck from the top of a hill and set it down gently some distance away.

The Sycamore (below, left) after landing in dense undergrowth near the Gordon River. On right, a view taken from the Sycamore of the Mount Lyell copper mine near Queenstown, Tasmania, which is worked by the Mount Lyell Mining and Railway Company.

The First D.H. Engine



By EDWARD A. GOUGH

SINCE de Havilland aero engines have successfully powered aircraft over the greater part of fifty years now, they can fairly claim to have had the longest career in British aviation. Although the name de Havilland was not generally associated with engines until the famous Cirrus family of the 1920s, the first D.H. unit was designed as early as 1908.

Bearing in mind England's late start in aviation, this was a remarkable achievement. Even in the most progressive aviation circles the idea of producing an "aeroplane engine" was barely eight years old; before 1900, aviators—apart from a few who attempted to adapt motor-car engines—were still prone to think in terms of manually operated paddles, flapping wings or steam-engines.

Credit for the idea of producing the first lightweight petrol engine specially for the purpose of propelling a flying machine must go to Professor Samuel Pierpont Langley. Around 1900, ably assisted by one Charles Manley, he designed and built the world's first aero engine—a surprisingly advanced five cylinder water-cooled radial. Langley's attempts to fly have been written down as one of the classic failures in aviation. His "aerodrome" (as he called his flying machine) ended up in the river Potomac on the two occasions that he tried to rise into the air. This was no fault of the Manley engine, which might otherwise have won the universal fame it deserved and had considerable influence on the course of later design. However, the arguments in favour of the petrol motor as the most practical power unit for an aeroplane were conclusively demonstrated when the Wright brothers made their historic flight in 1903.*

Only five years after this momentous event the young Geoffrey de Havilland entered aviation and designed his own aeroplane, engine and propellers. With the assistance of F. T. Hearle [who is today a director of the parent D.H. company] he also built the aeroplane and its propellers. It was a unique achievement and established a tradition for which the firm is justly famous today.

The first de Havilland engine, a horizontally opposed flat four, was of similar layout to several car engines of the day.

Geoffrey de Havilland's experience as designer to certain Midland car manufacturers, notably Wolseleys, had suggested to him the advantages of this arrangement. But the specialized application of an engine to power an aircraft called for revolutionary thinking in terms of power and weight, with the consequent lightening of every possible component. How far one could carry this process was a matter of trial and error, or happy inspiration, for there was no precedent to guide a designer who in automobile practice would normally pile on a few inches of metal where any weakness might be suspected.

When the drawings were completed they were put out to the Iris Motor Company of Willesden, who undertook the construction of the motor. The de Havilland Iris, as it came to be known, was one of the earliest British examples of a flat four aero engine. The French manufacturers Clement, Darracq and Dutheil Chalmers had already exploited the horizontally opposed type quite successfully, but the Iris owed little to them. The main features of the layout—the central mounting of the carburettor and H.T. magneto, with the flywheel at the rear—are seen in the heading illustration. Less obvious was the offsetting of the opposed cylinders, to allow individual attachment of each connecting-rod to the crankshaft. Cast-iron cylinders were employed and a copper water-jacket fitted to the outer section of each cylinder for the thermo-syphon cooling system. The paired cylinders were held in place by a triangular yoke which was pulled down onto the cylinder heads by three long studs passing into the aluminium crankcase; the drilled Meccano-like yoke illustrates the way in which lightness was achieved. One of the features of the Iris which put it in the forefront of engine design was the mechanical operation of both inlet and exhaust valves. Mechanical inlet valves were still something of an innovation, for the spring-loaded automatic-type inlet valve had had a good run of spluttering success to recommend it. The valves themselves were driven from a single camshaft mounted in a separate crankcase compartment and were of the opposed type, this time vertically, the inlet being placed above the exhaust and forming a kind of inspection point for it. Diagonal exhaust push-rods "nicely carried out" (according to a contemporary report) passed through the crankcase between the connecting-rods to operate the valves *via* bell-crank levers. These push-rods were hollow and the camshaft gear train also was "lightened out as much as is consistent with strength." The carburettor was of the float-feed type, with a celluloid-treated cork float; it was placed centrally on the crankcase, and long manifold arms each supplied two inlet ports.

The pistons were made in two parts; the crown and outer part carrying the rings were turned from solid vanadium steel accurately machined for uniform thickness, whilst the inner section carrying the gudgeon pin was a steel casting. In a detailed description of the engine in *Flight* for May 21, 1910, it was noted that Hoffman ball-bearings were used for the big-ends, mains and end-bearings and that Mr. de Havilland placed very great confidence in them as a result of his experience with them under extremely trying conditions.

Articles that appeared in the French magazines *L'Automotor* and *Génie Civil* in September 1909, gave a general description of the main features and performance of the Iris, and it is interesting to note that at that time it developed 25 b.h.p., a rating which was subsequently doubled with no increase in r.p.m. Finally the articles mention the promising tests made with an engine intended for use in an aeroplane, concluding . . . "Les essais d'un semblable moteur, destiné à un aéroplane, ont, parait-il, donné de très bon résultats." This was the engine fitted to Geoffrey de Havilland's biplane No. 1 which was nearing completion.

However, the trials of the No. 1 in December 1909 were unsuccessful. This is hardly surprising, for knowledge of even the most elementary kind was virtually non-existent and flying experiments in Britain were barely a year old. With enthusiasm undiminished, work on a second biplane was put in hand, this time using a stronger wood for the spars—American whitewood had proved inadequate. The undamaged Iris engine from the No. 1 biplane was recovered and fitted to the successful No II biplane.

It was not until six months later, at the Olympia Aero Show in March 1910 that the D.H. engine attracted interest in England. An example of the Iris engine was exhibited on the Handley Page stand and a brief mention was given in *The Aero*. But soon full recognition of this important addition to the handful of British aero engines available came with the comprehensive articles in *Flight* dealing with de Havilland biplane, engine and propellers. A warm welcome was extended to the young aviator for his enterprise in producing both his own aeroplane and a powerful light-weight motor to propel it.

Performance details of the engine were quoted originally as 40-45 b.h.p. at 1,500 r.p.m., the weight being 250 lb and bore and stroke 4½in and 4½in. However, in the week following the article *Flight* published a letter from Geoffrey de Havilland in which he gave some additional and corrected information on the engine's latest performance and pointed out:

> "With reference to the article in *Flight* re the de Havilland engine, I notice that the power of the engine is given as 40-45 h.p. at 1,500 r.p.m. Since the article was written, however, the usual adjustments required in a new engine have been made, with the result that 52 h.p. is developed at 1,500 revs. continuously, and 40 h.p. at 1,050. The weight is 200 lbs. in running order, but without fly-wheel, the latter weighing 30 lbs."

Only a few Iris engines were built, three being ordered by the Government and one installed in the Royal Aircraft Factory airship *Gamma*. But, as with aeroplanes, theoretical knowledge of aero engines, backed by practical experience, was in its infancy. Speaking in 1946, Sir Geoffrey de Havilland reflected on the problems of his first engine and said that "It suffered from a fundamental weakness in crankshaft design which resulted in crankshaft failure after a certain number of hours. The engine was of the flat-four type, popular today in light aircraft, but the crankshaft was two-throw and not four-throw as in modern engines, and the balance was therefore not good."

In spite of this the Iris gave of its best on September 10, 1910, when Sir Geoffrey made his first flight in the No. II biplane. For many weeks afterwards, too, it could be heard purring away happily over the Hampshire downs. In the New Year of 1911 it again performed magnificently at the War Office acceptance trials when both biplane and engine were bought and their designer offered an important post at the Royal Aircraft Factory under Mervyn O'Gorman—a long and fruitful association which produced some notable aircraft.

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* *On the return of the original Wright biplane and engine to the U.S.A. —a return which was delayed by the controversial claim for the first powered flight for Langley's "aerodrome"—apprentices of the de Havilland Technical School made replicas, which are now in the Science Museum. The 12 h.p. engine ran successfully on several occasions before it went into the National Aeronautical Collection.*

An opening for originality

Aeroplanes are usually designed to a customer's specification. He knows what he wants and sets it down in great detail. The designer, who can often make an invaluable contribution to the drafting, gives the specification substance and purpose—if he believes in it. If he does not he should "retire to the country".

An aircraft specification can be a document of destiny. Shrewdly drawn, wisely interpreted, it can bring a designer or aircraft company fame, make an airline prosperous or a country secure. Imperfectly devised, it can wreck a bright reputation, bring economic disaster to an airline, or greatly weaken a country's defences.

Those who draw up aircraft specifications must have special qualities of judgment. They survey the whole field of aircraft engineering, armament and aircraft operation. They must have access to knowledge of all that is new and all that is in prospect. They must be free from bias and adept at avoiding the Scylla of exuberance and the Charybdis of undue caution. As in all scientific advances the search for truth requires unimpeachable integrity.

Here at least, is the specification for the writers. To expect them to achieve 100% success would be naive in the extreme, indeed even deluded.

The measurement of progress before it is made can never be immune from error. Demands may sometimes fall short of what is possible or desirable, or go a little beyond. The result may be costly failure, and the name of another aeroplane that might have become famous has to be added to the ebony scroll of the 'one-offs'. Occasionally, the specification's errors can be superbly retrieved — as happened for instance when, after the failure of an officially inspired fighter, private enterprise produced the immortal Spitfire.

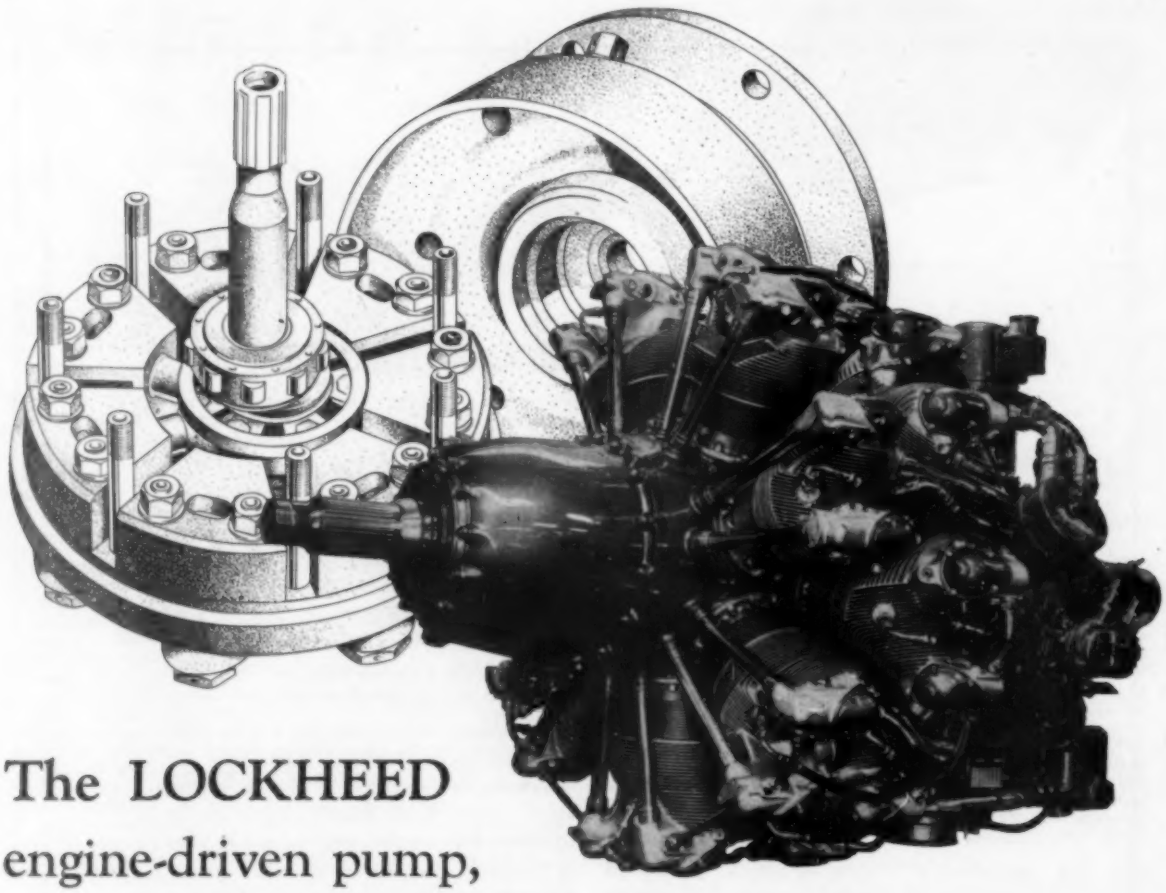
Specification writers can err, too, by their omissions. As history well knows, they did not create the Mosquito, a gunless bomber which became World War II's most versatile warplane. Nor did they write the specification of the Gnat, the privately built light fighter which supplements the conventional fighter in any air force and serves as a perfect substitute for it in all but a few.

The Gnat is half the size and a third the weight of the conventional fighter, yet has the same speed, superior rates of climb and turn, and a greater operating height, coupled with an advanced armament and equipment. With it go all the advantages accruing from small size, light weight and simplicity of structure and equipment—low cost, rapid and quick manufacture, ease of operation and of maintenance. The four versions — single-seat interceptor, fighter bomber, carrier-borne fighter and two-seat fighter trainer — are all derived from one basic airframe.

For many of the smaller countries it makes possible a first-class air defence from home production, a major contribution to their freedom.

In producing the Gnat, private enterprise grasped an opening for originality which the specification writers had overlooked.

Folland Aircraft Limited, Hamble, Southampton, England



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engine-driven pump,
the heart of the hydraulic system on the
HANDLEY PAGE 'HERALD'
fitted with the ALVIS LEONIDES MAJOR ENGINE

ALSO LOCKHEED AVERY COUPLINGS: PUROLATOR* FILTERS

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ALL-BRITISH Lockheed

FOREMOST IN HIGH-PRECISION HYDRAULICS

AUTOMOTIVE PRODUCTS COMPANY LTD., LEAMINGTON SPA, WARWICKSHIRE, ENGLAND

Background to the New Comet 4A

A 92-seat, 530 m.p.h. Comet

ON page 138 we record the news of the Capital Airlines order for four Comet 4s and ten Comet 4As and comment is made in a leading article. Here we provide the background to this historic announcement, and give first details of the new medium-range jet transport.

IN a leader on May 11 we remarked how entertaining it would be to listen in at the keyhole of almost any medium-haul airline's boardroom door. We imagined the bewildered chairman trying to make the right choice from among the nine medium-range jet and turboprop airliners—American and European—now on the market, and we remarked upon the great opportunities for the British manufacturers. With the long-haul jet market conceded to the DC-8 and 707, it seemed opportune for them to burst down the door with their medium-range airliners and to sell as they had never sold before. We know now that D.H. were already kicking at the door harder than we thought.

The present story really began about six months ago when, on the U.S. West Coast, Convair and Douglas began to try out airline-reaction to two newly drafted medium-jet projects, respectively the Skylark (since named Golden Arrow) and the DC-9. Boeing had a project also.

What started as a light flirtation quickly developed into ardent courtship. The suitors found the airlines most susceptible to the argument that the public, having once tasted jet travel on long-haul routes in the sixties, would demand it on regional routes also. But the airlines found the courtship of the turboprop suitors equally hard to resist.

The choice, if one dare so over-simplify, lay between glamour on one hand and running costs on the other. In the U.S., four airlines had already succumbed to the charms of the turboprop Electra, and competing domestic operators began to wonder whether, by having jets, they might not be going one better. It would mean waiting two years longer: Electra delivery-date was 1958 compared with 1960 for the Golden Arrow and 1961 for the DC-9. But on June 20 the market broke; T.W.A. and Delta decided to buy 40 Golden Arrows between them, for delivery starting in 1960.

Then, earlier this week, Capital put the jet among the pigeons by ordering four Comet 4s and ten Comet 4As for 1958 and 1959 delivery. It was a satisfying moment for de Havilland.

Events in the U.S. had been followed closely at Hatfield. Even before Capital first showed an interest last April, the immense new opportunities for the Comet were clearly seen. Here was a jet airliner that, given the orders, could beat the field by about two years on delivery-date, and which, unlike its paperware competitors, had seven years' hard and continuous flying experience behind it. In Mk 4 form, it was almost ready-made for the medium-jet market.

Almost ready-made—but, for Capital, not quite. The 505 m.p.h. cruising speed of the Comet 4 was some way below the 575 m.p.h. of its projected American competitors, and furthermore it was designed to the hitherto accepted jet formula of cruising at 40,000ft to get the maximum number of miles out of every pound of fuel. The Comet 4, as ordered by B.O.A.C., is in fact a medium-sized long-hauler, capable of carrying 16,400 lb payloads over 3,000-mile stages. As such it has a wide application on all but a few of the world's major trunk routes for those operators who do not need aircraft of DC-8 or 707 size—size which is a function of the geographical fact that the North Atlantic is 3,000 miles across, and swept by strong west winds. But the Comet 4's requirement to fly high did not make it an ideal aeroplane—from the point of view of economy and block speed—for short and medium stages, by which are broadly meant routes of from 500 miles to 1,500 miles. It was this fact that inspired de Havilland to develop the Comet 4A to meet Capital's specifications.

The problem was to make the Comet 4 go faster lower down. Extra speed was sought that would offer block times within a few minutes of those offered by the later Golden Arrow and DC-9. How far could the Comet 4's 240 kt indicated airspeed limit, dictated by structural considerations, be raised? Cruising at higher indicated speeds at lower altitudes required re-examination of the wing, rear fuselage and tail stress-cases under the higher gust loads; wing bending-moments were accordingly reduced by a 7ft clipping of span (from 115ft to 108ft), coupled with structural stiffening of the rear fuselage and tail. The net result was that the aeroplane was made structurally adequate for 320 kt indicated—an increase of no less than 80 kt. The altitude at which the 320 kt curve intersects the curve of Mach 0.74 is 23,500ft, equivalent to a true airspeed in standard conditions of about 530 m.p.h., or 545 m.p.h. in I.S.A. plus 20 deg C. This is equivalent to a true Mach number of 0.75. As illustrated in Fig. 1, 23,500ft is obviously the height, therefore, for the fastest block time, which on a 1,200-mile stage including 15 min terminal time is of the order of 470 m.p.h.

Although 23,500ft is the height where the Comet 4A's Mach and indicated speed operating limits intersect, and the height for maximum block speed, the aeroplane can of course be operated like

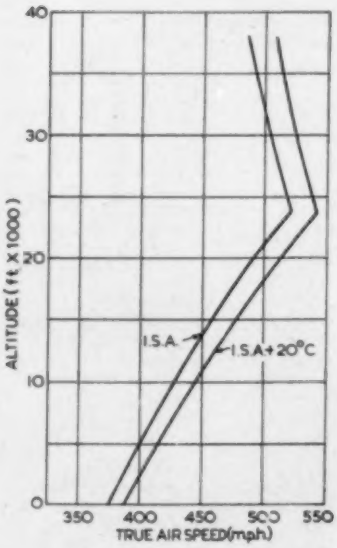


Fig. 1. Normal operating limit true air speed versus altitude. The placarded speed limits for the Comet 4A are 320 kt indicated and Mach 0.74; the graph (left) is a plotting of the true air speed implied by these limits. It will be seen that the altitude for the highest block speed is 23,500ft.

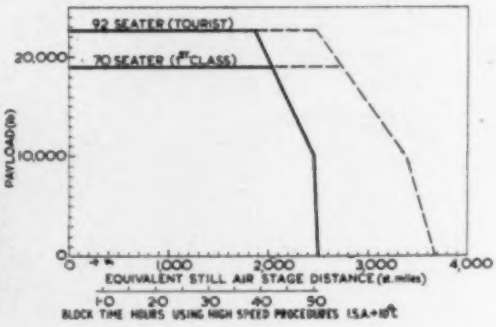
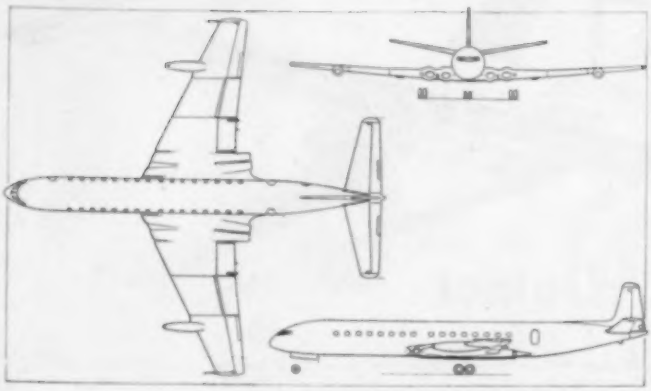


Fig. 2 (right). Payload versus stage-length, still air. The full lines apply to high-speed procedures, i.e., cruising at 320 kt at 23,500ft. The dotted lines apply to long-range procedures, cruising at M=0.74 and 1.2 times the speed for minimum drag. Block time includes 15 min terminal time. Full fuel reserves are included.



General arrangement of the Comet 4A. Compared with the Comet 4, external differences are a 7ft reduction of span, and a 3ft 4in increase in fuselage length. Leading data appear below.

A 92-SEAT, 530 m.p.h. COMET . . .

the Comet 4 according to the high-altitude "climb-cruise" technique for long-range operations. The procedures for (1) high speed, and (2) long-range operations are respectively as follows: (1) After take-off, accelerate to 240 kt at 5,000ft and 275 kt at 7,000ft. Maintain the latter speed until the desired cruising altitude is reached, where the aircraft is levelled off and accelerated to the desired cruising speed. Throttle setting is 7,300 r.p.m. from immediately after unstick until cruising speed is reached at cruising altitude, when the engines are throttled to 7,150 (RA.29 recommended cruise). (2) After take-off, accelerate to 240 kt at 5,000ft, maintain this speed up to 30,000ft, and thereafter decrease speed by 3 kt per 1,000ft. R.p.m. are 7,150 up to 30,000ft and thereafter 7,300. The old technique of increasing r.p.m. with height, therefore, applies only to long-range operations.

Having increased speed, the next step was to increase payload to offset the higher fuel bill. A 40in stretch of the fuselage was made, together with a most significant increase in zero-fuel weight of no less than 4,000 lb: capacity tourist payload increased from 19,300 lb to 22,690 lb. This is perhaps the most significant difference between the two aircraft. The Comet 4A's tourist accommodation, as will be seen from the accompanying illustration, allows for 92 five-abreast seats, an increase of 16 compared with the tourist-class Comet 4.

Direct operating cost, even when the aircraft is operated according to the low altitude high-speed procedure, remains competitive: although the fuel bill on, say, 1,000-mile stages amounts to some 49 per cent of the total (compared with the Comet 4's 27 per cent), the total direct operating cost still represents a break-even load factor on American routes of about 50 per cent on 600-mile stages (this is roughly Capital's mean stage-length). Although this does not equal the standard of economy set by the turboprop ("No one," observe D.H., "would claim that it did"), it still means a big margin for profit. Even on 200-mile U.S. sectors, the 4A will pay its way 80 per cent full. Curves for direct operating cost, calculated to both S.B.A.C. and A.T.A. methods, are shown in Fig. 3, and for quick reference a table of the S.B.A.C. cost breakdown is given. It is important to note that no allowance is made for revenue from the 4A's 2,672 lb of freight capacity.

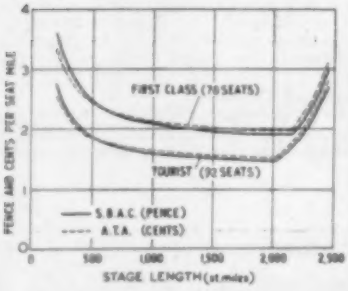


Fig. 3. Cost versus stage-length. The full lines and dotted lines are respectively calculated according to the S.B.A.C. and A.T.A. standard methods. Both curves neglect freight revenue (freight capacity is 2,672 lb.).

Stage length (st. miles)	200	500	1,000	1,500	2,000
Block speed (m.p.h.) ...	269.5	380	438	462.5	475.5
Fuel costs (£/hr)	128.1	130.9	132.1	133.1	134.0
Fixed costs (£/hr)	125.9	125.9	125.9	125.9	125.9
Landing costs (£/hr) ...	28.6	16.1	9.3	6.6	5.0
Total direct cost (£/hr) ...	282.6	272.9	267.3	265.6	264.9
Total direct cost (sh/mile)	21.0	14.4	12.2	11.5	11.1
Total direct cost (d/seat-mile, first-class)	3.59	2.46	2.09	1.97	1.91
Total direct cost (d/seat-mile, tourist)	2.73	1.87	1.59	1.50	1.45

The essential features of the Comet 4A may be summarized as follows. Where appropriate, comparative figures for the trunk-route Comet 4 appear in italics.

Comet 4A and Comet 4 Leading Data *(figures in italics are for Comet 4):* Max. gross weight, 152,500 lb (*152,500 lb*); max. landing weight, 113,000 lb (*113,000 lb*); max. zero fuel weight, 96,000 lb (*92,000 lb*); tankage, 8,730 Imp gal (*8,950 Imp gal*); representative max. payloads, 70 first-class seats, four-abreast at 39in pitch; 19,070 lb, limited by volumetric capacity (*58 seats: 16,400 lb*); 92 tourist seats, five-abreast at 38in pitch; 22,690 lb, limited by zero fuel weight (*76 seats: 19,300 lb*); max. stage-length in still air with max. payload and reserves using high-speed techniques: 2,040 st miles first-class, 1,880 st miles tourist; using long-range techniques: 2,730 st miles first-class, 2,480 st miles tourist (*2,950 st miles and 2,710 st miles*); max. cruising speed at 23,500ft: 522 m.p.h. T.A.S. in I.S.A., or 543 m.p.h. T.A.S. in I.S.A.+20 deg C (*506 m.p.h. in I.S.A. at 33,800ft, climbing to 41,000ft*); S.B.A.C. direct operating costs over 1,500-mile stage neglecting freight revenue: 1.9d per seat-mile first-class, 1.5d per seat-mile tourist; typical take-off balanced field length at maximum gross weight, sea level, I.S.A., British requirements, 6,500ft (*6,380ft*); landing runway length at max. landing weight, sea level, British requirements, 6,420ft (*6,250ft*); U.S. requirements, 6,000ft; representative price, including radio and customer furnished equipment, £1.21m (*£1.18m*); stalling speed in free air, 152,500 lb, take-off flap, 115.5 kt (*114 kt*); at typical 108,000 lb landing weight, landing flap, 93 kt (*92 kt*); span, 108ft (*115ft*); length, 114ft 10in (*111ft 6in*).

The flying development programme for the immediate future includes certification flight-testing later this year of the Comet 3 prototype fitted with the Avon RA.29s of the Comet 4 and 4A The aircraft will have detachable outer-wing panels to enable quick conversion from the Comet 4A to the 4 for test-flight evaluation. The prototype Comet 3 is in fact to be made fully representative of the 4 and 4A in all essentials: for example, the developed cabin air system will be installed; the controls will be brought up to the latest standard, including elevator g-feel; and the new split bus-bar electrical distribution system will be incorporated. Thus a fully representative aircraft will become available for certification flying about 18 months before delivery of Comet 4s and about 30 months before delivery of Comet 4As. A second aircraft—the first true Comet 4—will supplement the programme next year.

Whatever doubts there may be about the Convair Golden Arrow and the DC-9 being delivered on time—and there is little room for complacency here—there seems no reason whatever why the Comet 4 and 4A, with the immense experience already behind them, will not be on schedule. As with the airframe, the continuous development of the Avon over many years and millions of flying hours will present a solid foundation for commercial operation.

While on the subject of the Rolls-Royce Avon RA.29, the makers now estimate that overhaul life will reach 1,500 hr three years after first commercial operation. Greatrex silencers will be fitted to reduce noise; coupled with the Comet's climb gradient after take-off, steep even on cruising power, noise is not likely, D.H. consider, to cause a serious problem.

There is no doubt that the Comet 4A makes very sound sense indeed. Its adoption by one of America's leading domestic operators for operation on a network linking such cities as Washington, Detroit, Cleveland, Chicago, Milwaukee, Pittsburgh, New York, Minneapolis, St. Paul, Buffalo and New Orleans is a challenge that will ring out loudly in the lists of the U.S. domestic industry. It means, as did Capital's introduction of the Viscount, that a new form of travel will be offered to the U.S. public by an airliner at least two years ahead of its competitors. However, as we remarked also in our May 11 leading editorial, it would be imprudent to suppose that, great though the international opportunities for the medium jet now appear, the turboprop's tightening grip on regional traffic will be easily loosened. There is a place for both creeds, one professing low operating cost, the other high speed—particularly on routes where speed is the all-important competitive commodity.

For de Havilland Inc. of New York, the associated D.H. company which handles spares and service for 90-odd Doves in U.S. operation, a big expansion in activity is in prospect. And in the D.H. factories at home, especially at Hatfield and Chester (one of Europe's biggest aircraft production plants), a renewed sense of purpose is the order of the day. Hats are not yet being thrown too high in the air; rather are the brims being pulled more purposefully down. But it may well be that we shall look back on July 24, 1956, and say: "That was when the medium-jet race began." Just as, on October 13, 1955, the stampede for the big jets started. J.M.R.

Advance of the second prototype Herald is recorded by this picture taken late last week at Handley Page, Woodley, by "Flight's" photographer. Progress of Handley Page's branchliner is recounted elsewhere in this issue.

CIVIL AVIATION

B.E.A. SIGNS VANGUARD CONTRACT

SOME £20m-worth of business was formally taken on by Vickers-Armstrongs, Ltd., last Friday when British European Airways signed the final contract documents for their fleet of 20 Vanguards, and an additional 16 Viscounts. B.E.A.—if options on a further 19 Viscounts are taken up—will have a Viscount-Vanguard fleet of more than 100 aircraft by 1960, representing a £50m investment in the turboprop. The contracts were signed by Lord Douglas for B.E.A. and by Major-General C. A. L. Dunphie, chairman of Vickers-Armstrongs Aircraft, Ltd.

The 16 Viscounts for which the contract was signed were, as recorded in *Flight*, Oct. 21, 1955, fourteen 806s and two 802s. The first 802 (of which a picture appeared in last week's issue) may fly in a matter of days, and is due for delivery to B.E.A. in the late summer. The first 806—in effect an 802 with the more powerful Dart RDa.7 engines—will be delivered in the late summer of next year. The first Vanguard is expected to fly in the autumn of 1958 and deliveries to B.E.A. are due in the spring of 1960.

DR. WARNER TO RETIRE

IT was announced at the close of the recent 10th Assembly of I.C.A.O. at Caracas that the president of the Council, Dr. Edward P. Warner, has declined to stand for re-election for a new term. He will continue to preside over the Council pending the election of a new president, although he will not serve beyond March 1957.

Dr. Warner has been president of the I.C.A.O. Council since its inception in 1946. He is one of the most distinguished of international aviation personalities.

AWARDS FOR ACTUALS

EVERY year, the Guild of Air Pilots and Air Navigators presents two awards to captains of civil aircraft for long and meritorious service in the provision of weather reports; these "actuals" from civil aircraft assist the Meteorological Office in compiling and checking forecasts made for other aircraft. The recipients this year were Captain A. Caeser-Gordon and Captain F. A. Tricklebank, who received briefcases from Sir Graham Sutton, C.B.E., D.Sc., F.R.S., director of the Meteorological Office, at a ceremony at Londonderry House last Tuesday. A number of suitably inscribed books were also presented to the following captains and navigators for the best series of reports during the past year:—

Captains G. M. Alcock, G. R. Buxton, R. A. J. Hanson, K. E. Buxton, K. W. Fordham, C. M. Longden, and Navigators H. L. Chandor, G. F. Andrews, H. Fogg, J. S. Blain, F. S. Tanner, J. Broadley, all of B.O.A.C.; Captains R. H. Payne, R. H. Rose and W. J. Wakelin of B.E.A.; and Captain S. A. Calder and First Officer D. E. Goldsworthy of Britavia.

SMOOTH MACHINERY

THE way in which the I.A.T.A. airlines reconciled widely differing points of view to reach agreement on transatlantic fares and rates in the Traffic Conference at Cannes (*Flight*, June 29) has been described by Sir William Hildred, the Association's director-general. The problem, he said, "contained as many ingredients as a Christmas pudding" and each airline—to start with—had a different point of view. The final outcome, however, was a typical piece of I.A.T.A. teamwork. The over-riding motive had been the determination, particularly by PanAm and T.W.A., to go for a drastic decrease in the number of dollars required to cross the Atlantic. Supplementary considerations were the size of the fleets of the different operators and their age; the desire of some operators for a 15-day excursion fare; the views on the "three-tier" fares structure; the problems of sleepers and sleeperettes; and the question of the Family Plan.

Some airlines, said Sir William, began with the conviction that if fares could be lowered an immense flood of new traffic would be generated. Others were not so sure. Again, some felt that if the major airlines did not make a move towards the cheaper fares —in spite of the present small profits—the business might pass to the non-scheduled operators willing to try the cheaper fares because they had no need to fly in the winter or to operate non-profitable routes. "It was interesting . . . to see how the voting went hour after hour. Everyone present was in favour of a lower fare system—the question was: When?" A dozen alternatives had been put before the meeting and it was by a careful watch on the voting abstentions (rather than the Yes and No votes) that the way was felt toward a compromise recommendation to be put before the governments. Since an abstention indicated an affirmative vote, it was an indication to the others that the voter would "go along," although he was not enthusiastic. The North Atlantic group met outside the main conference at all hours—early morning, lunch, afternoon and evening—until everyone knew exactly what

(Left) C.P.A.L. can beat T.C.A. when it comes to father-and-son flight crews. Following our April 13 picture of the Hollinsons of T.C.A. comes this one of C.P.A.L.'s Capt. Bob Randall and his 23-year-old twin sons Bob (centre) and Ted. They were photographed in their DC-6B before departure from Vancouver for Amsterdam by the trans-polar route.

(Right) First picture of the Viscount's built-in folding stairs in production form—an optional extra on all new Viscounts.

CIVIL AVIATION . . .

was in everyone else's mind. "I have sat in conferences when the number of votes that have been taken on different alternatives have run into scores, and it was interesting to find each man's mind gradually coming closer to the other man's with varying degrees of reluctance until, finally, a proposition stood forth which no one would vote against, from which some would abstain, but which attracted the maximum number of adherents. This teamwork led finally to a unanimous recommendation to governments."

CONTROL CONVENTION

THE Guild of Air Traffic Control Officers are to hold a convention at Southend-on-Sea on October 4 and 5, with the object of bringing together representatives of all those who make use of A.T.C., as well as the equipment operators and manufacturers. Lectures will be given on "The pilot's aspect of air traffic control" and "The future of military air traffic control in the United Kingdom" by senior civil airline and R.A.F. officers, and the Guild's technical committee will state their recommendations for improving A.T.C. in the United Kingdom.

The Guild are anxious to obtain a representative attendance, and interested persons or organizations should ask the Clerk of the Guild for full details. Sufficient time will be devoted to questions, which will be answered by A.T.C. and industry representatives, and should make the conference a valuable clearing house for fresh thoughts on this important subject.

BEALL AND END-ALL

THE fortieth anniversary this month of the Boeing Airplane Company was the occasion for a little reminiscing and satellite-gazing by the senior vice-president, Mr. Wellwood E. Beall. "The next 40 years will see an old saying disproved," he predicts. "Some things that go up will not come down—at least, not to earth." Commenting that the future of civil aviation was arriving so fast that his inclination was to duck, Mr. Beall added: "I think that I can see clearly what to expect by 1975. Beyond that are only vapour trails."

That anniversaries are no time for worried doubts we are quite sure, and Boeing, with orders for over a hundred 707s beneath their belts, are as competent as anyone to look to the next course—in fifteen years' time. "We can foresee," they say, "a 200-passenger jet transport with a maximum speed of 1,500 m.p.h. at 50,000ft elevation. It will fly from Seattle to New York in 1 hr 45 min, and from New York to Paris in 2 hr 25 min." By 1975 it will, we agree, be quite unthinkable to take much longer—except, perhaps, from terminal to town.

In our "Airliners" issue (July 6) we commented upon the appearance of an East German jet-liner project with two large podded engines. This "Flight" drawing shows a later version with four engines. It is reported that at least one prototype is being built.

BREVITIES

MR. G. H. FREEMAN, chairman and managing director of Transair, has been elected chairman of the British Independent Air Transport Association, a post relinquished by Sir Archibald Hope on his recent appointment to the board of D. Napier and Son, Ltd. Captain T. W. Morton has been elected vice-chairman of B.I.A.T.A.

* * *

Qantas are reported to have said that they may announce a DC-8 or 707 order within the next few months.

* * *

The Indian Government are negotiating for the purchase of six Ilyushin 14s.

* * *

Air France have opened a freight handling unit at London Airport Central.

* * *

B.O.A.C.'s general sales manager, Mr. Gilbert Lee, has strengthened his sales organization by the appointment of four regional sales managers at head office in London.

* * *

Britannia G-ANBH, which has been in Entebbe carrying out a "confirmatory" series of engine de-icing tests, will probably fly on to India for trials in monsoon conditions. G-ALBO is being re-engined with Orions, and the first 300 is due to fly next week. Bristol hope to show both aircraft at Farnborough.

* * *

Qantas has just completed a successful Super Constellation proving flight into Kai Tak, Hong Kong, in anticipation of a service early next year from Sydney *via* Darwin and Manila.

* * *

Mr. Max Keller, previously assistant relations manager at Zurich, will succeed Mr. A. Kuhn as sales manager of Swissair in U.K. and Ireland as from August 1.

* * *

Although Sir Harold Whittingham has retired from the post of director of medical services to B.O.A.C. he will continue in a part-time consultative capacity as medical adviser. Dr. K. G. Bergin has been appointed medical superintendent, Air Services, and Dr. A. S. R. Peffers as superintendent U.K. Medical Services.

* * *

West Hartlepool (Greatham) civil airport serving the Teesside has been reopened with a full aerodrome licence for day and night operations with V.H.F. R/T and homing facilities. Considerable improvements have been made to the grass landing area, which has marked runways; the longest run is 3,800ft. It is reported that £42,500 is expected to be spent between now and 1961.

A heliport is now being constructed on top of an eight-story Warsaw building. Two more will be completed within five years, and similar heliports will be built in all major Polish cities.

* * *

A Dutch mission has reopened negotiations in Washington to extend K.L.M.'s Atlantic routes to California and Texas. The Dutch are said to be protesting about U.S. discrimination against K.L.M. in granting permission to other European airlines to fly to cities in the U.S. interior.

* * *

S.A.S. has increased its trans-polar flights Los Angeles-Copenhagen to one per day. The airline has denied that it is behind plans for the building of a civil airport at Spitzbergen.

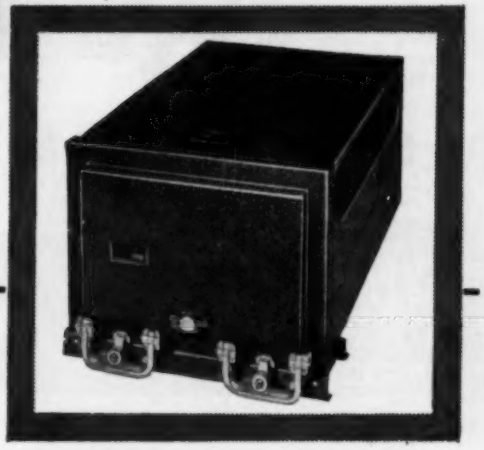
* * *

Mr. William Lear, of Lear, Inc., who recently flew his Cessna to Moscow, reported that the control tower was using only four frequencies and was unable to speak much English. Russians who looked over his aircraft "could not believe" that it had 800 frequencies, or that Western airlines regularly used up to 360.

Mr. Peter Masefield (right), now managing director of Bristol Aircraft, had his first business association with his former colleagues on July 20 when he handed over a Bristol 173 to Lord Douglas (left), chairman of B.E.A., and Mr. Anthony Milward, chief executive. The first twin-engined helicopter ever to be taken over by an airline, the 173 was flown from Bristol to B.E.A. headquarters at Ruislip. "Flight" photo

MARCONI SELF-TUNING MULTI-CHANNEL HF COMMUNICATION EQUIPMENT TYPE AD307

Pilot-operated radio telephony



The type AD 307 has been designed to meet the requirements of international airline operators. Full frequency coverage is coupled with extreme simplicity of operation. Its features include:

- **Automatic frequency changing with self-tuning circuits throughout.**
- **Up to 200 crystal controlled channels.**
- **Valves replaceable by standard American types.**
- **Remote-control from two alternative positions.**
- **Self-tuning feature eliminates the need for skilled adjustment.**
- **100-120 watts on telephony.**
- **Choice of carbon or electro-magnetic (including noise-cancelling) microphones.**
- **Designed for use with DC or AC aircraft systems.**
- **Plug-in unit construction is employed for easy servicing.**

More than forty Airlines and twenty Air Forces fit Marconi air radio equipment. Marconi airport installations are in use throughout the world.

Illustrations: *(Top)* Power Amplifier Unit. *(Centre)* Drive and Receiver Unit. *(Left)* Modulator and Power Unit. Not shown is the automatic Aerial Tuning Unit.

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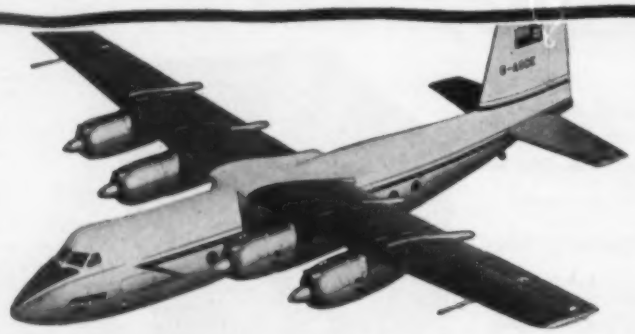

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SW/30

CORRESPONDENCE

The Editor of "Flight" is not necessarily in agreement with the views expressed by correspondents in these columns; the names and addresses of writers, not for publication in detail, must in all cases accompany letters.

Flight Refuelling

IN answer to Mr. Dorman's challenge, in *Flight* for July 13, that as a critic of flight refuelling for civil airliners I should include solutions for overcoming the objections to such a method of increasing the range or reducing the take-off weight of airliners, may I take what must appear to be the easy way out and refer to page 76 of the same issue of *Flight*? Lord Brabazon is quoted, under the heading "A.R.B. Last Year," as saying: "Or should we give proper attention to fuel economy, silence, reverse thrust, deflected thrust, lower landing speeds and shorter landings, and to a concentrated attack on laminar flow?"

Surely that is the answer, not flight refuelling?

Admittedly, all credit must be given to the way in which the R.A.F. and the U.S.A.F. have developed flight refuelling; but if they could use aircraft which did not need such a complicated technique, no doubt they would jump at the chance.

Whilst most anxious to give credit to the lead which military aviation has given to civil in many aspects of development, there are many operational techniques which are used by civil operators but have not been adopted by the military because, although they would undoubtedly increase the safety of flying, they would be a "restrictive practice" in combat operations.

Of course, we can have flight refuelling but we must add up the possible consequences. For just one west-bound thirsty airliner:—A radar control centre, a "private" airspace with "out of bounds" notice, a large £1,000,000 tanker, double insurance (both receiver and tanker must be considered as a whole for the purpose of assessing the probability factors of mishap) and a special radar interception set in the receiver. In addition, who is going to sort out the sticky question of "who commands the operation, the tanker captain or the 'thirsty one'?" By the time the operational techniques have been established, to the satisfaction of all interested parties, Dr. Lachman and his suck-and-blow pipe will have softly laminated the "stop me and buy one" aircraft at the becoming speed of sound.

London, N.W.2. L. F. E. COOMBS.

"The Hi'-Land Duster"

IN *Flight* for December 23, 1955, on page 928 ("A Dak Goes Top-dressing") you described the James Aviation, Ltd., Dakota. I live in Hamilton where the aircraft was converted and enclose photos [one is reproduced above—Ed] of this aircraft, known as "The Hi' Land Duster."

It carries five tons of fertilizer in a big hopper fitted centrally. There are double openings in the top of the fuselage for loading and two more in the bottom of it for unloading.

The Dakota does not operate from Ardmore only but from any aerodrome where there is sufficient room. The registration letters are ZK-AZL.

The Dakota and its big loader (see letter below).

The loader is a big cream and black Thornycroft with a large boom. On the end of the hopper lifting wire is a big "halter" scale which measures in tons! The loading hopper, made of steel, weighs 15 cwt and has a canvas chute at the bottom.

The colour of the aircraft is drab khaki below with a coloured band just above window level. The top is painted white.

Hamilton, New Zealand. V. N. BENTLEY.

Twin Pioneers

I AM bewildered by the significance that your correspondent Mr. Dennis M. Powell places on my statement that some 200 orders for Twin Pioneers have been placed. This figure, which was given to me not only by Mr. D. F. McIntyre but also by other officials of Scottish Aviation, Ltd., was quite irrelevant to the purpose of my article in *Travel World*, which was to draw attention to the suitability of the aircraft for feeder services. I may have misunderstood Mr. McIntyre and others of his management, but is it so very important providing that the virtues of this unique Scottish aeronautical achievement are made more widely known?

London, W.1. W. D. C. CORMACK.

Flying Objects, Identified and Unidentified

IN reply to Mr. J. T. Bennett's query about the D.H.9A with spare wheel (*Flight* for July 13), the example I have shows a military machine, series No. E87 with the ace of clubs on the fin.

I and many other people were interested in Mr. J. E. Reynolds's letter on Unidentified Flying Objects (*Flight*, May 25). The object I saw on Friday, November 6, 1953, at 1.20 p.m. came into view from the west in a break of 7/10 altostratus cloud. Its flight was slow and erratic and its shape oval and silvery. Suddenly it stopped with a jerk and stayed perfectly still for about ten seconds, then continued its wavering course above broken wafer cloud. I would have reported this had I a witness but many people like myself refrain from doing so, fearing ridicule. As an ex-R.O.C. observer this is understood. I think Mr. Reynolds's letter deserves an article in *Flight* on the subject.

Birmingham, 14. MAURICE AUSTIN.

THE INDUSTRY IN BRIEF

United Kingdom (and Lebanon) agents for the Kaman helicopter described on page 173 are Field Aircraft Services, Ltd., Croydon Airport, Surrey.

* * *

Maintaining standardization with their existing fleets, B.O.A.C. are specifying the Aro A-12A regulator for crew oxygen on the Britannia 102. This light-weight unit is manufactured by the recently formed British Oxygen Aro Equipment Company.

* * *

From Engineering Developments (England), Ltd., Mark Road, Hemel Hempstead, Herts, come details of their EDM 103 fluorescent light unit for interior assembly or maintenance work. The light, a two-foot 40 Watt fluorescent tube working from 230 or 240 volt mains, can be swivelled through 180 deg and the reflector tilted at any angle. So that electric tools can be connected direct to the unit, a power take-off plug is built into the base, which in addition contains the necessary control gear.

* * *

So popular have the overhaul exchange schemes operated by Hants and Sussex Aviation, Ltd., proved that the amount of floor-space allocated for engine overhauls at their City Airport, Portsmouth, premises has been trebled. Often testing is carried out "round the clock" and a similar scheme has now been applied to all forms of components, parts and accessories, such as magnetos, ignition harnesses and cylinder assemblies. To make this possible, the A.R.B. approval has been extended to cover electrical servicing.

* * *

A new type of universal hose clip has been marketed by F. H. Bourner, Ltd., of Aldrington Basin, Hove, 3, Sussex. Known as the "Coronation," it uses a nut and bolt mechanism, while alternative adaptors provide easy access in awkward places.

* * *

A vibration generator designated V.G.109 and described as the largest of its kind developed on this side of the Atlantic has been completed by Goodmans Industries, Ltd., Axiom Works, Wembley, Middx. Designed particularly to test guided-weapon components, it produces a thrust of plus or minus 8,000 lb at continuous rating. Diameter of the V.G.109 is 50in, height about 40in and its weight approximately 6¼ tons.

* * *

At the invitation of the Public Schools Appointments Bureau, some 30 careers and science masters from schools all over Britain, together with two headmasters, spent a day looking round the Radlett and Cricklewood works and aerodrome of Handley Page, Ltd. They discussed the aircraft industry from the careers aspect with senior members of the company and heard from Sir Frederick Handley Page about the industry's great need for suitable recruits.

SENT TO COVENTRY (Continued from page 142)

THIRD ROUND AND FINAL RACE PLACINGS

Place	Pilot	Aircraft	H'cap m. s.	Speed m.p.h.	Total points	Final place
S.B.A.C. Cup						
1	A. S. K. Paine	Proctor 1	00 32	151	46	2
2	G. C. Marler	Falcon Six	02 20	169	56	1
3	E. Crabtree	Proctor 3	00 23	145	44	3
4	R. R. Paine	Hawk Sp. 6	03 29	182	28	6
5	P. S. Clifford	Hew Gull	04 48	203	28	6
6	F. Dunkerley	Sparrowjet	04 16	194	38	4
Dis.	W/C. R. H. McIntosh	Proctor 3	00 00	—	30	5
Dis	S/L. J. Rush	Falcon Six	02 15	—	20	8
N.S.	J. N. Somers	S.K.1	—	—	—	—
Osram Cup						
1	T. G. Knox	Proctor 3	00 49	137	48	1
2	A. Barker	Proctor 3	01 15	141	48	1
3	J. E. G. Appleyard	Chilton D.W.1a	00 00	129.5	32	7
4	P. Blamire	Gemini 1a	00 32	133	40	4
5	J. N. Somers	Chipmunk	00 55	133	46	3
6	E. Crabtree	Gemini 3	03 10	154.5	34	6
7	E. N. Husbands	Proctor 3	00 58	131	18	8
8	J. R. Johnston	Hawk Tr. 3	00 46	127.5	40	4
Kemsley Trophy						
1	S/L. D. P. Boulnois	Tiger Moth	00 00	101	56	1
2	J. H. Denyer	Auster J.1N	02 12	117	48	3
3	C. Gregory	Taylorcraft Plus D	01 11	108.5	42	4
4	J. H. Donald	Tiger Moth	00 05	101	50	2
5	J. W. Tomkins	Messenger 2a	02 45	121	14	7
6	W. P. Bowles	Monarch	03 15	125.5	26	6
7	B. J. Snook	Tiger Moth	00 58	105	36	5
Goodyear Trophy						
1	H. B. Iles	Miles M 18/2	03 03	130	56	1
2	D. F. Ogilvy	Comper Swift	02 44	126	54	2
3	N. H. Jones	Tiger Moth	00 49	109	40	4
4	Miss A. Windle	Hawk Tr. 3	01 38	114.5	38	5
5	N. D. Norman	Tiger Moth	00 15	103.5	28	6
6	P. Vanneck	Tiger Moth	00 09	102.5	26	7
7	B. Maile	Tiger Moth	00 35	104	24	8
8	A. G. Oldham	Tiger Moth	00 00	99	42	3

field—and, indeed, every other item—were magnificent.

There remained the two heavy-class entrants, G. H. Wheldon in the Provost and G. Worrall in the Meteor 7/8 G-ANSO. Aileron turns made in and out of loops, and inverted recoveries from over-the-vertical stalls, were notable among Wheldon's figures, although some of his inverted turns were rather vaguely defined. Worrall in the Meteor had obviously the most difficult task, with a large and fast aircraft requiring lots of space. His steeply banked inverted turn was well-placed and accurate.

The six finalists were Biancotto, Bishop, Blaha, Hisler, Wheldon and Worrall. Blaha of Czechoslovakia was the only one not to change his programme during the restrictive weather of Saturday afternoon. And his bunts, stall turns, rolling circuit, horizontal eight, and flick rolls were if anything even more polished than those of the previous day. Bishop, too, seemed to give a tighter and more precise display.

Hisler seemed to waste not a second as he again crammed in one twisting manœuvre after another, to form a modified pattern which was impeccably tailored to the day's weather conditions. Biancotto's flying, in an off-the-cuff display which was more restrained than that of Friday, was every bit as accurate and well-controlled. Clearly his aircraft was the perfect vehicle for such artistry.

Wheldon's climbing roll and roll-off in the Provost were especially precise in Saturday's display, and his control of the aircraft during a hesitation roll was noteworthy. Handicapped to the largest extent by the weather was Worrall in the blue "civil" Meteor which nevertheless had, in his hands, the grace and freedom of a porpoise—even though, perforce, it had to move in the rolling rather than the looping plane. As his finale Worrall inverted the Meteor at low level and selected "down" to achieve an opposite movement of the landing gear.

The prizewinners in the competition, announced later, were: 1, Biancotto (France); 2, Blaha (Czechoslovakia); 3, Hisler (France); Group 1 winner, Wheldon (Great Britain); Group 2 winner, Biancotto. Although no marks were announced the relative judging of Biancotto, Blaha and Hisler must certainly have caused the judges many headaches. There was indeed little to choose between three superb displays.

The Flying Display. Any display which had to follow such aerobatic excellence needed to be good—and Coventry's programme was no disappointment. The aerobatic contest, indeed, had obviously inspired Lt. J. G. Brigham, R.N., and his Whirlwind helicopter, whose lively —nay, abandoned—performance opened the bill. The only regret during the display was at the non-appearance of the famed Skyblazers team.

Before the King's Cup race there were two further items, different in style yet equally impressive. Four Canberra T.4s from Bassingbourn, led by S/L. F. P. Walker, made some nice-looking sweeps across the field, changing from line astern to box formation, and (after a rolling break-away) gave a superbly co-ordinated "set piece" involving simultaneously a low-speed run, a steep climb, and fast, low cross-over passes by the individual machines. In slightly improving weather, the Mystère IVAs of the Patrouille de France bored in, rock-steady, with wheels down, to begin a well-drilled and confident display. Although lacking the airspace for loops (a feature of their normal programme) they presented a smooth selection of tight turns and formation changes, the sun coolly glinting on their swept wings at each circuit. For their final rolling break-away the Mystères spouted green trails, with the exception of the port wingman—who, a spectator suggested, had "run out of chlorophyll."

After the race, it was the turn of the Hunters—the aerobatic team of 111 Squadron, led by S/L. Roger Topp. Elegant rolls and formation changes were featured in the team's display, which ended with an orange-trailed break-away. Four Valiants from 543 Squadron at Wyton, led by W/C. R. E. Havercroft, next arrived in formation and peeled off to set up a pleasantly low circuit in which individual machines gave slow, accelerating, and fast runs past the crowd.

Four Gannets of No. 825 Naval Air Squadron, Culdrose, trundled into the next spot on the programme, spreading their wings and taking off in formation from Baginton. The formation, led by Lt-Cdr. J. R. C. Johnston, split into two pairs to demonstrate the Gannet's various configurations and abilities. A quieter interlude followed, as Christian Ladouet made a delayed parachute drop, landing in the racing-aircraft park, and as Vic Carr of the Coventry Gliding Club released his Olympia from the towing Tiger to begin a graceful series of sailplane aerobatics. Why not a sailplane class, one wondered, in the Lockheed aerobatic contests?

From St. Eval, Cornwall, came F/L. D. F. Robertson of the R.C.A.F. in a tastefully blue Shackleton, preceding the brisk performance of four Sea Hawks from 810 Naval Air Squadron at Lossiemouth, led by Lt-Cdr. P. M. Lamb. And no one-colour nonsense for the Sea Hawks' final break-away, as their red, green and blue trails showed. But it was Warwick County's own Auxiliaries who stole the late-afternoon show with six Vampire 5s from Honiley, led by S/L. R. E. Tickner. Maybe the Hunters, Mystères and Sea Hawks *could* fly pretty good formations—well, so could 605's Vampires, with the exhilarating addition of a noisy, low, weaving, follow-my-leader chase which brought the show, and the crowd, suddenly alive. Last item on the programme was a massed drop by 13 French Army parachutists from a Noratlas, who landed precisely, if jarringly (no bent-knees routine here), in front of the public enclosures.

The King's Cup Race. With Marler, Boulnois and Iles level in the British Air Racing Championship with 56 points after the morning's races, their relative positions in the King's Cup race would decide the winner. Boulnois' Tiger was first away, beating in low over the enclosure from behind the Alvis hangars and into the first leg of the course. Twelve minutes later the leading Tigers were rounding the aerodrome pylon after their first lap, as Buster Paine's red Proctor was taking off.

There were few changes during the first lap. Gregory's Taylorcraft overtook Norman Jones' Tiger, while Nat Somers and Johnny Johnston moved respectively up and down two places.

As the rear men were coming round after their second lap, Marler having moved up in front of Crabtree, Johnston's cream Hawk Trainer was seen making a deadstick landing, downwind, in the centre of the field. Engine failure was the cause. There was a two-minute gap between Crabtree's Gemini beginning its third lap and Boulnois coming in to "do an Ogilvy" round the pylon and into his final lap. Only significant trend during the third lap was that Buster Paine had passed Barker and was now moving up fast.

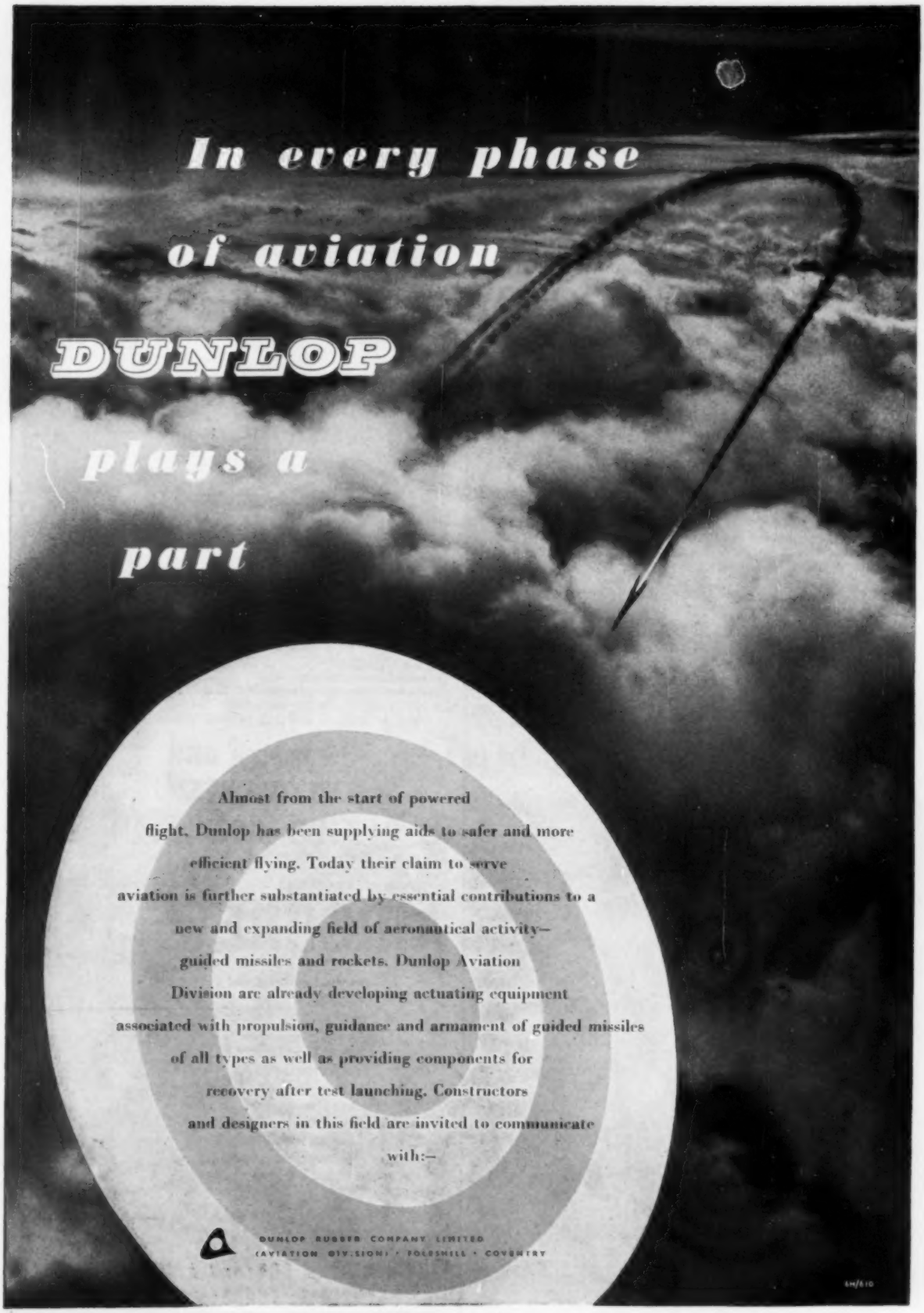
Naturally enough, it was only during the final lap that things began to get really interesting. From the Church Lawford turn we heard that Denyer had moved up from sixth to third place, with Boulnois still leading. At the last turn into the final leg Denyer was in front, and indeed Newcastle's blue Auster with its red-haired pilot was first past the finishing line in relative comfort.

After him, the deluge. Five machines in and across in a handicapper's dream of a finish: Paine's red Proctor, right up from next-to-last to next-to-first; *Black Magic*, passed almost on the line by Paine; Somers' Chipmunk; Blamire's Gemini, and Knox's black Proctor, No. 66. A pause for breath, and then Gregory and Iles. A brace of Tigers, very low—Boulnois and Donald, with Marler's Falcon Six unable to make up its quarter-hour handicap. Jones, Oldham, and Barker, and finally the Crabtree (ex-Somers) Gemini G-AKDC. Although there have been closer King's Cup finishes, the handicappers had done well.

On the results of this race (below) the King's Cup was awarded to Denyer, while Paine, Ogilvy and Somers received respectively the Air League Challenge Trophy, Norton-Griffiths Challenge Trophy and Grosvenor Challenge Cup for their placings. Iles had beaten Boulnois and Marler (respective placings 8th, 9th and 11th) and so became British Air Racing Champion.

The Prizegiving. Following Saturday's flying display, prizes were presented to the winning pilots by King Feisal of Iraq, who had been a visitor to the meeting. Trophies and third-round prizes were presented, and it was announced that Barker and Knox (who tied for the Osram Cup) would each receive a cup and would share the first-place prize-money.

Pilot	Aircraft	H'cap m. s.	Speed m.p.h.	Place
J. H. Denyer ...	Auster J. 1N ...	05 29	124	1
A. S. K. Paine ...	Proctor 1	12 22	153.5	2
D. F. Ogilvy ...	Comper Swift ...	08 03	133	3
J. N. Somers ...	Chipmunk	10 55	146	4
P. Blamire	Gemini 1a	10 23	143.5	5
T. G. Knox... ...	Proctor 3	10 49	145.5	6
C. Gregory ...	Taylorcraft Plus D	03 02	114.5	7
H. B. Iles	Miles M.18/2 ...	09 18	137.5	8
S/L. D. P. Boulnois	Tiger Moth ...	00 00	106	9
J. H. Donald ...	Tiger Moth ...	00 10	106.5	10
G. C. Marler ...	Falcon Six	15 39	171	11
N. H. Jones ...	Tiger Moth ...	02 54	103.5	12
A. G. Oldham ...	Tiger Moth ...	00 42	107	13
A. Barker	Proctor 3	11 56	148.5	14
E. Crabtree ...	Gemini 3	15 13	164.5	15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Kaman Helicopters for Civil Sale

THE Kaman twin-rotor, five-seat utility helicopter, type K-600, is now available for sale as a civil aircraft. Up till now the development and production potential of the makers—Kaman Aircraft Corporation, Bloomfield, Conn., U.S.A.—has been entirely absorbed by the military version for the U.S. Marine Corps, the HOK-1. The Service order was placed after the machine had won a design competition for a multi-purpose utility helicopter for transport, reconnaissance, casualty evacuation and rescue duties.

The K-600 is powered by a Pratt and Whitney R-1340-48 Wasp giving 600 h.p. at take-off and a maximum continuous 550 h.p. Its rotor diameter is 47ft and its empty weight 4,040 lb. Maximum fuel capacity is 100 U.S. gal. The two intermeshing two-blade, counter-rotating rotors are mounted on slightly divergent pylons and the blades are flexible, so that their pitch can be controlled entirely by the movement of small aerodynamic tab surfaces attached to each trailing edge. There is no tail rotor, and three large vertical fins together with an elevator surface are mounted at the extremity of two short tail booms. The control system, it is claimed, gives exceptional stability and lightness of control for a machine of this type.

The engine is mounted aft in the tail of the main fuselage section, and there is accommodation for freight or passengers in the nose. The pilot sits on the right-hand side, and the port half of the transparent nose hinges on its outboard edge to allow convenient loading of large objects such as stretchers. In addition two sliding doors give access to the sides of the cabin. The undercarriage consists of four wheels on light outriggers which can be fitted with "bare paw" pads for operation from soft surfaces. The company offers a variety of kit conversions to adapt the K-600 rapidly for external cargo slings, stretcher carrying, instrument flying and hoist rescues. Other specialized equipment includes self-sealing fuel tanks, dual flight controls, cold-weather equipment and float landing gear.

The company claims that the K-600 offers exceptional altitude performance, as shown by the following figures taken from Kaman and U.S. Navy flight tests performed under standard conditions defined by N.A.C.A. For altitude performance a gross weight of 5,800 lb would give the following alternative load combinations: one 200-lb pilot, four 200-lb passengers, 94 lb baggage and 600 lb fuel; one 200-lb pilot, one 200-lb co-pilot, 694 lb cargo and 600 lb fuel; one 200-lb pilot, 894 lb cargo and 600 lb fuel. In this condition range would be 220 statute miles and endurance 3 hr 20 min. Endurance, range and maximum speeds would be respectively 50 kt, 65 kt and 95 kt. The service ceiling at this weight is 18,000ft and the rate of climb 1,300ft/min. Hovering ceiling with ground effect is 12,000ft.

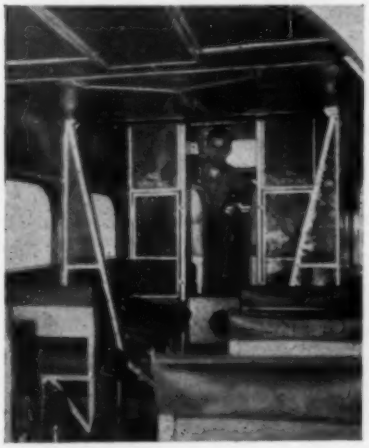
An HOK-1 of the U.S. Marine Corps. Note the two counter-rotating and intermeshing rotors and the four-wheel undercarriage.

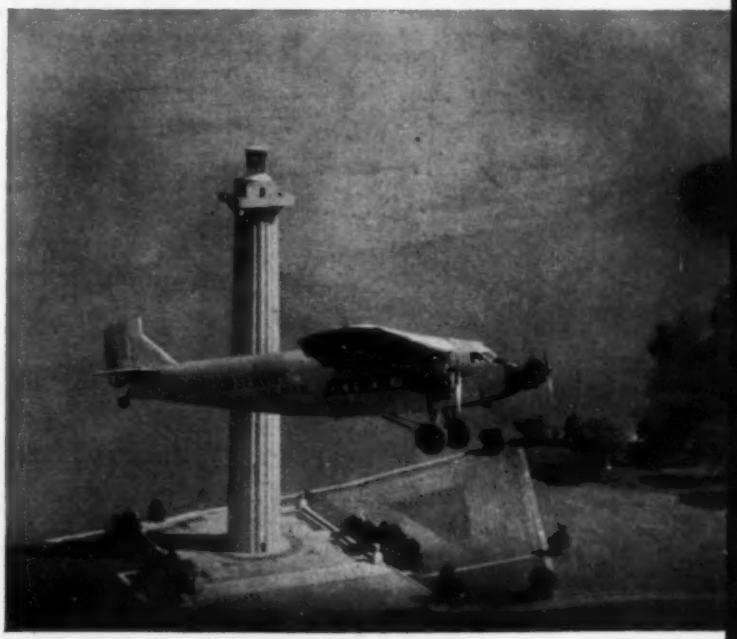
Another load case is quoted as indicative of the K-600's performance at sea level, when a suitable gross weight would be 6,800 lb. In this case service ceiling is 17,000ft and maximum rate of climb 700ft/min. Maximum speed is 88 kt with a hovering ceiling of 8,500ft with ground effect and 3,000ft without it. The useful load would be 2,760 lb. The highest gross weight quoted in the company's brochure is 6,906 lb, consisting of one 200-lb pilot, 2,000 lb of externally-hung cargo and 600 lb of fuel. In this condition the vertical rate of climb is quoted as 300ft/min and the maximum rate of climb in translational flight 700ft/min.

Kaman Aircraft have a maintenance school to train mechanics in servicing and maintenance of the K-600. Its facilities were originally provided for the U.S. Navy and U.S. Marine Corps but are available also to intending civilian operators. The K-600 has undergone the usual range of military tests relating to operation in extreme climatic conditions.

BREATH OF THE BYGONE

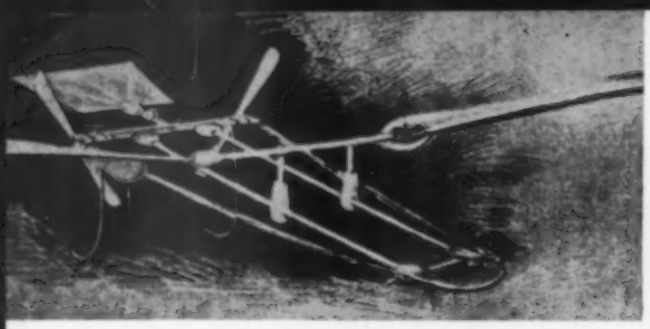
A SMALL airline based at Put-in-Bay, Ohio, claims to be the "most veteran-equipped" airline in the U.S., and also to be operators of the country's shortest schedules. Known as Sky Tours, Inc., their fleet comprises two old 15-passenger Ford-built (1926) Trimotors (the U.S. airlines' mainstay in the 'thirties), and a 1932 Boeing. Their service is a daily routine of short hops between the flock of small islands in Lake Erie and the mainland. In a quarter of a century of carrying passengers, mail and livestock, the company "has never injured a passenger—or a cow."





(Right) One of Sky Tours' two old Trimotors climbs away from Put-in-Bay, Ohio, past the monument to Commodore Perry's victory over the British in the battle of Lake Erie in 1812. If the pilot cannot see the monument from the airport he stays on the ground.

(Left) President Ralph I. Dietrick in the cockpit of a Trimotor. A veteran pilot, he purchased the airline nearly three years ago for £34,000 and is at present looking for two more Trimotors.



Tanski's first flying model, built in 1894 (left), and, on the right, the glider in which he became airborne in 1896. The aircraft he designed and built with Cywinski and Zbieranski in 1909-11 is shown below.

CZESLAW TANSKI

"The Father of Polish Aviation"

By J. B. CYNK

ONE of the most outstanding figures in the history of early Polish aviation was Czeslaw Tanski. Some of his designs were very advanced by contemporary standards, yet his work is completely unknown outside Poland, and a short account of his experiments may be of value to students of aviation history, and will serve as an appropriate tribute on the 60th anniversary of the first successful glide made by him in Poland.

Czeslaw Tanski was born in 1863 in a small town near Grojec and after leaving school studied art and eventually became a painter. Ever since his early youth he had shown a great interest in the problem of flight and spent long hours patiently watching insects and birds, of which the stork particularly attracted his attention. Then with the results and calculations obtained from a study of its flight Tanski started his first practical experiments in 1893.

In 1894 he designed and built a flying model, which was the first successful heavier-than-air device flown in Poland. This model was propelled by two pusher propellers rotating in opposite directions and powered by rubber strings. The tailplane was adjustable and so were the wings, which could be set independently at required angles of incidence. This gave the model excellent manœuvrability and enabled it to perform a full circle in the free flights; and thus more accurate measurements were made possible as a flight path in each case might be easily predicted. The model was designed as a wooden frame with wing of plan-form characteristic of the stork's wings. A few more models were built, all of them having good flying qualities.

By then Tanski decided to design a man-carrying glider, called by him *Lotnia*. His first example was not successful—its main snag was lack of longitudinal stability. The third, an extensively redesigned version of *Lotnia*, was ready by the middle of 1896. The wooden frame of the "fuselage" had been lengthened, a horizontal tail added and four triangular, vertical areas in frame structure were covered with fabric. Two short struts were employed to support "stork-type" wings. Weight of the *Lotnia* was almost 40 lb; span 27.9ft; length 12.2ft; wing area 75.34 sq ft; and tail area 10.76 sq ft. Then, sixty years ago (in June 1896) Tanski—holding *Lotnia* in his arms, and running quickly on the flat ground near Janow Podlaski—became airborne. He had reached a height of about 6.5ft and flown in a straight line over a distance of more than 100ft. This was the first flight by a man on a heavier-than-air device in Poland and it started the history of practical flying in that country. It is also claimed as the world's first ascent by a man from flat ground without assistance from any source of power. Later that year, and during 1897, Tanski made several flights in *Lotnia* from a specially built wooden tower, many of them over a distance well in excess of 100ft, calculating lifting capabilities for different speeds of air currents.

In later years he built several very successful models of aeroplanes and helicopters. Full-scale experiments, however, were severely handicapped by complete lack of funds. In 1904-5, Tanski designed a new glider and aircraft with two tractor airscrews propelled by the muscular power of the pilot's feet. Some work on those proposals was done, but they were abandoned owing to lack of money. The first helicopter designed in Poland was built by him in the years 1907-8. He could not afford to buy an engine, so he had again to employ the pilot's muscle power. This gave lift for only 26.5 lb, which was insufficient to raise the machine and pilot. The metal mast of the helicopter consisted of two co-axial shafts, to which two two-blade rotors, rotating in opposite directions and set one above the other, were fixed. The span of each rotor was 27.9ft. Blades resembled in shape the wings of the *Lotnia*; the pilot was attached to the mast by a special system of belts and operated a hand-driven gearbox propelling the rotors.

To promote the idea of flying, and looking for financial support, Tanski, together with other enthusiasts, organized in 1909 the first aeronautical exhibition in Poland. In this exhibition, held in Warsaw in the hall of the Engineers' Association, Tanski showed over 20 of his models, many drawings and photographs. Towards the end of 1909 he designed an aeroplane with the collaboration of Cywinski and Zbieranski. This was a biplane, the upper wing having a span of 29.5ft, and the lower 26.25ft. Wings and biplane-type tail unit were made of wood covered with fabric. An uncovered metal frame of triangular section constituted the fuselage. The engine with its tractor airscrew was fitted in the front of the pilot's seat. Construction of this biplane progressed very slowly, due to the extremely difficult conditions under which the pioneers were working. A room they had transformed into the traditional workshop was so small that the whole aircraft structure had to be taken outside and erected in the yard each time fitting or checking of newly made parts was required, and then dismantled again for storage. Parts of the wings were hung on the walls. When, owing to lack of space, work came to a complete standstill, Tanski obtained permission to use the workshops of the "Aviata" Association (formed in Warsaw for the promotion of flying). Their aeroplane was finally completed in 1911 but a new difficulty had arisen. The only available engine—a radial Anzani—was not powerful enough for satisfactory flights. Some time elapsed before a new engine, a 40 h.p. E.N.V. of eight-cylinder vee type, was fitted. With it the aeroplane made several flights, showing very good flying qualities.

Despite the continual drawbacks and lack of funds, Tanski designed and built another aeroplane. This time it was a monoplane with the 50 h.p. Gnome, slightly resembling Blériot's types in general layout. The wings were of Tanski's favourite "stork" shape, and its metal fuselage was of triangular section.

At this point financial difficulties forced him to abandon further work. Before the outbreak of the First World War, all work on aeroplanes was banned by the Russians, who were then occupying part of Poland, including Warsaw, and both aircraft were grounded. Tanski, bitter and disappointed, gave up all his aeronautical activities. Part of the documentary materials regarding his work was destroyed during the 1914-18 war. All the remaining material was bought in 1927 and placed in the Science Museum in Warsaw, where it was all subsequently destroyed during the Second World War.

In assessing the work of Tanski and other Polish pioneers of flying prior to 1914, it must be remembered that until 1918 Poland was divided amongst three occupying powers, Austria, Germany and Russia. The main moral and financial effort of the Polish people was directed toward the fight for independence, and designers could obtain only a limited support from their fellow countrymen. Not only was there no possibility whatsoever of obtaining any official help, but the occupying powers did their best to suppress all aeronautical activity by the Poles. There was also a very limited amount of technical publications, so designers were bound to rely mostly on their own knowledge. Despite this, in the years 1909-14, a considerable number of gliders and aeroplanes were designed and built, and some of them proved to be quite outstanding by the standards prevailing in those days.

An intimate and unusual glimpse of Fairey Gannet A.S.1 anti-submarine aircraft—the nearest of which, at least, has its arrester hook extended. These Gannets belong to No. 812 Squadron, carried in H.M.S. "Eagle."

SERVICE AVIATION

Royal Air Force and Fleet Air Arm News

The R.O.C. and Nuclear War

THE Royal Observer Corps has a new rôle (with the Home Office Air Raid Warning Organization) of monitoring radio-activity. The ability of the Corps to produce information about nuclear fall-out and the ability of the Air Raid Warning Organization to collate and interpret it would be vital to the survival of this country in any future war. Should nuclear war break out, R.O.C. observation posts would report radio-activity intensity readings to Groups, who would report to R.A.F. operations rooms so that warnings could be given and radio-active areas plotted. In nuclear war, radio-active dust clouds may travel hundreds of miles and cover thousands of square miles; but they would move slowly and in time for warnings to be given in accordance with the prevailing winds. People taking cover in a slit trench, cellar or house would get good protection. Met. forecasts would be used to give preliminary warnings when required, but these would have to be checked by initial reports of where fall-out was actually taking place.

The R.O.C. organization, with its existing network of observation posts, is ideal for this purpose. The Corps would use survey meters (or "dose-rate meters") to work out dose-rates when on monitoring duty. Teams at operations centres would convert these reported dose-rates into "standard time" rates and would then, in the light of weather information, give warnings of impending fall-out, after "H" hour (the time of explosion). The dose rate is measured in Roentgens per hour. Radio-active contours would be shown on special charts to some extent resembling weather charts. Met. forecasts used for issuing warnings would have to take into account weather up to 100,000ft, which illustrates the importance of upper-wind research. The R.O.C. posts, by their readings and reports, would be a safeguard against a sudden change of weather nullifying the effect of such warnings as might happen with our changeable climate. A radio-active cloud could drift over from as far away as the Continent. Here again, the first warning might be that provided by the initial readings from R.O.C. posts. For this reason, the first step in nuclear defence is the instruction of observers in the use of radiac instruments; it is on the efficiency of the post observer that the whole of this monitoring and warning organization has to be built.

Permanent staff of the Corps have already been undertaking special courses of instruction to qualify them to instruct post members in radiac instruments operation and some field trials have already been held. The next field trial will take place in the autumn.

A.V-M. Saye

THE Air Ministry announces the appointment of A.V-M. Geoffrey Ivon Laurence Saye, C.B., O.B.E., A.F.C., as Air Officer Commanding No. 19 Group, Coastal Command.

A.V-M. Saye has been Air Officer in charge of administration at Headquarters, Middle East Air Force, since January, 1954. Born in March 1907, and educated at Repton, he entered the R.A.F. College, Cranwell, in 1925. He served for seven years with flying-boat squadrons at Calshot and Mount Batten, and in 1930 was a member of the first Royal Air Force crew to fly to Iceland. For the two years ending 1936, A.V-M. Saye was adjutant at R.A.F. Station, Heliopolis, Cairo, and afterwards took the specialist navigation course at the School of Air Navigation, subsequently becoming Navigation Staff Officer at No. 1 (Bomber) Group. In 1939 he went to France with Headquarters, Advanced Air Striking Force, returning to Britain in 1940 to become Navigation Staff Officer, first at H.Q. Flying Training Command, and then —from December 1940—at H.Q. Bomber Command. From July 1942, he commanded R.A.F. Waterbeach, a bomber station, until taking command of the Central Navigation School at Shawbury in 1944. Later that year he became Director of Navigation at the Air Ministry. A.V-M. Saye returned to the Middle East in 1948, as Group Captain (Organization) at Abu Sueir. In May 1950 he became Director of Manning at Air Ministry, and then took the 1953 course at the Imperial Defence College. Awarded the Air Force Cross in 1933, he was appointed O.B.E. seven years later, Mentioned in Despatches in 1942, and in 1948 was appointed C.B.

Fighter Command Appointment

THE Air Ministry announces that Air Commodore P. G. Wykeham, D.S.O., O.B.E., D.F.C., A.F.C., who has been serving as Assistant Chief of Staff Operations at Headquarters, Allied Air Forces Central Europe, has been posted to Headquarters, R.A.F. Fighter Command, as Air Commodore Operations, from July. A. Cdre. Wykeham was born in 1915 and enlisted as an aircraft apprentice in 1932, after which he was awarded a Cranwell cadetship, passing out in 1937. After serving in the Middle East, during which time (1941) he commanded No. 73 Sqn., he returned to the United Kingdom to command No. 257 Sqn. and, afterwards, No. 23 Sqn. When serving in the Western Desert he was shot down in enemy territory and, after making his way back on foot, immediately returned to flying duties. He later led the first Mosquito intruder sorties from Malta and in 1943 flew the first Allied aircraft over Rome since the beginning of the war. Later he commanded the Kenley fighter sector, and in 1944 No. 140 Wing, leading it in the famous raid by 24 Mosquitoes on the Danish Gestapo H.Q. in Copenhagen. He was credited with at least 15 enemy aircraft destroyed in World War II. After the war A. Cdre. Wykeham became a M.o.S. test pilot. He was loaned in 1950 to the U.S.A.F. in Korea to give advice on fighter-intruder technique and earned the American Air Medal while piloting aircraft on numerous hazardous strikes against the enemy, becoming the first Briton to be decorated in the Korean fighting. After commanding R.A.F. North Weald in 1951 he commanded R.A.F. Wattisham until he went to A.A.F.C.E. He

(Right) Lt-Gen. Kammhuber (right), Chief of Staff of the West German Air Force, and Air Chief Marshal Sir George H. Mills together recently at the Fontainebleau headquarters of NATO's biggest air command.

(Left) Commanding the R.A.A.F. base at Amberley is G/C. D. W. Kingwell, D.S.O. Amberley is the home of No. 82 Wing.

SERVICE AVIATION . . .

was awarded the D.F.C. in November 1940, a Bar to the D.F.C. in August 1941, the D.S.O. in May 1943, and a Bar to the D.S.O. in October 1944, and was three times Mentioned in Despatches.

Farewell to the Dragonfly

HAVING undertaken casualty evacuation and general transport flying in Malaya since August 1950, Westland Dragonfly helicopters have now been withdrawn from service in the Far East Air Force. The last Dragonflies of No. 194 Sqn. have now been replaced by Bristol Sycamores. This unit, however, remains inseparably connected with the Dragonfly, for the insect from which the aircraft took its name is incorporated in the squadron badge. When Dragonflies first went to Malaya they operated as a Casualty Evacuation Flight, which was later expanded into No. 194 Sqn. They pioneered helicopter operational techniques in Malaya, penetrating areas of deep jungle, inaccessible to other forms of transport, and saved the lives of many members of the security forces. All members of No. 194 Sqn. (S/L. C. R. Turner, A.F.C.) turned out to say goodbye to the last Dragonfly when it left Kuala Lumpur recently for the maintenance base at Seletar, Singapore.

A.T.C. in Camp

NEARLY 21,000 cadets of the Air Training Corps are to spend part of their summer holidays in camp at R.A.F. stations in Great Britain and Northern Ireland. Fifty-six R.A.F. stations will be hosts, some catering for as many as six separate camps over a six weeks' period. Camps will be held during the period July 21 to September 1, at stations ranging from St. Mawgan in Cornwall to Kinloss in Scotland and Aldergrove in Northern Ireland. In addition to the cadets from 748 A.T.C. squadrons, some 3,000 boys from the Royal Air Force sections of the Schools Combined Cadet Force—representing 121 schools—will also go into camp at R.A.F. stations. Each squadron or section will spend a week in camp, where their training will be enlarged by as much flying and practical work as can be arranged.

Undergraduates in Training

FORTY-ONE undergraduate members of the technical flights attached to the Nottingham and Southampton University Air Squadrons have volunteered for training with the R.A.F. during the summer vacation. Some will do part of their training gaining experience in servicing aircraft in near-tropical conditions, in Malta. Before leaving the U.K., first-year cadets from both universities are attending the R.A.F. Technical College at Henlow, Beds, for twelve days where they will see specialist equipment not normally found in universities. A different programme has been arranged for second-year students, most of whom went to Malta last year. These students will go direct to Germany for a two weeks' attachment to units of the 2nd Tactical Air Force. The units have been selected to give them as wide experience as possible; the first five days will be spent at R.A.F. Station Butzweilerhof, and the remainder of the period at R.A.F. Station Fassberg, and R.A.F. Station Jever. Their programme will include a variety of technical subjects, such as control and reporting organization and high altitude interception techniques, and the students will visit many places of interest including the city of Cologne.

No. 42 Sqn. History

A HISTORY of No. 42 Sqn. (W/C. E. Donovan) is being written. Will anyone who has any information or records concerning the squadron since its formation at Filton in April 1916, forward it to the Adjutant, No. 42 Sqn., Royal Air Force, St. Eval, Nr. Wadebridge, Cornwall? Documents and photographs will be copied and returned.

As recorded last week, a Standard was recently presented to No. 19 Squadron at Church Fenton. Here Air Chief Marshal Sir Donald Hardman, who was a member of the unit nearly 40 years ago, is seen driving to his aircraft after the ceremony in the squadron's own cherished London taxi, which carries full insignia.

Defence of Malta Exercise

EXERCISE "MALTEX", the annual inter-Allied joint Service defence of Malta exercise, began at midnight on July 15. Its purpose was to test not only the joint defences of Malta itself, but also to a limited extent the air defence sectors to the north and west of Malta. The exercise consisted of four phases—deployment of the forces involved, a working-up phase, which lasted until midnight on July 18, an active defence phase from then on and, beginning on the last night of the exercise, simulated atomic bomb attack to test Malta's civil defence.

R.A.F. Appointments

THE following continues the list of Royal Air Force appointments which appeared in our previous issue:—

S/L. V. W. Hinkley is appointed to R.A.F. Hornchurch, for President, Selection Board, duties (with the acting rank of wing commander); S/L. R. Howard to H.Q., Fighter Command, for technical staff duties (with the acting rank of wing commander); S/L. A. J. Moody to the Air Ministry, for duty in the Department of the Chief of the Air Staff (with the acting rank of wing commander); S/L. V. G. Owen-Jones, D.F.C., to R.A.F. Waterbeach, for administrative duties (with the acting rank of wing commander); S/L. J. E. Tipton, D.F.C., to Air Ministry for duty in the Department of the Chief of the Air Staff (with acting rank of wing commander); S/L. C. E. Castle, M.B.E., to R.A.F. Butterworth (Malaya), for technical duties (with acting rank of wing commander); S/L. H. W. Hill to R.A.F. Melksham, for administrative staff duties (with acting rank of wing commander); S/L. F. Healey to No. 49 Maintenance Unit, to command (with acting rank of wing commander); S/L. S. A. Fentum to R.A.F. Feltwell, for technical duties (with acting rank of wing commander); S/L. R. MacDonald to H.Q., No. 5 (LAA) Wing, to command (with acting rank of wing commander); S/L. G. F. McMahon, D.F.M., to R.A.F. Weeton, for administrative duties (with acting rank of wing commander) and not to H.Q., Middle East Air Force, as announced recently.

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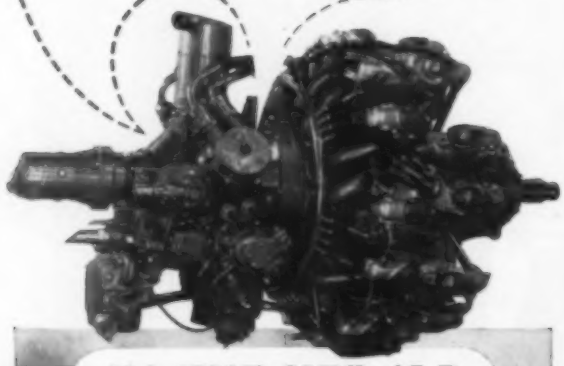

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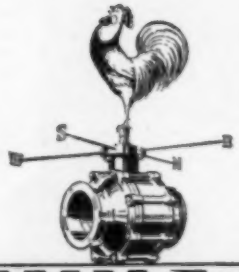

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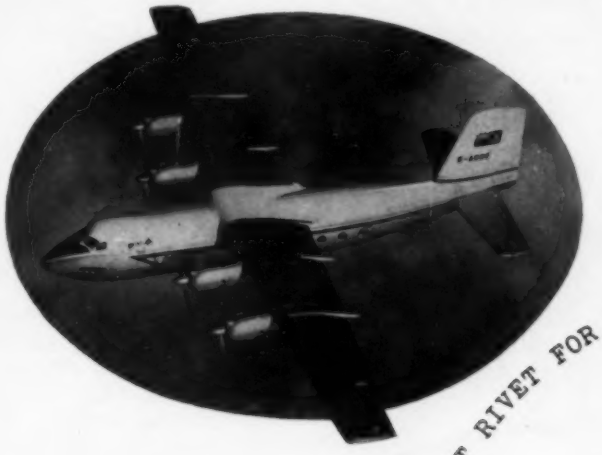

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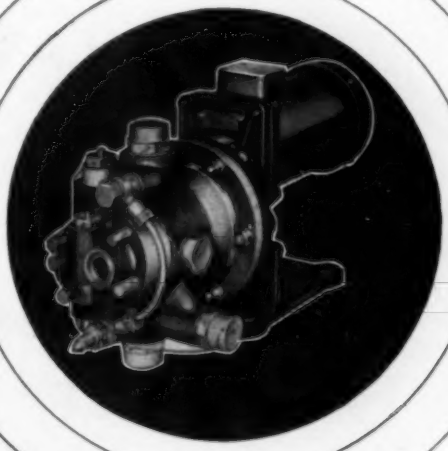

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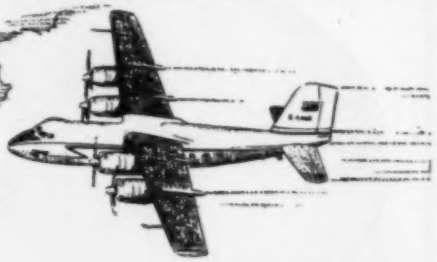

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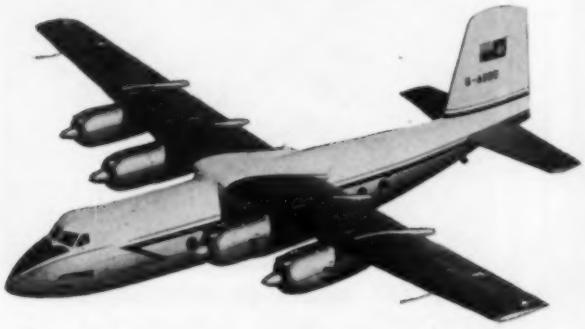

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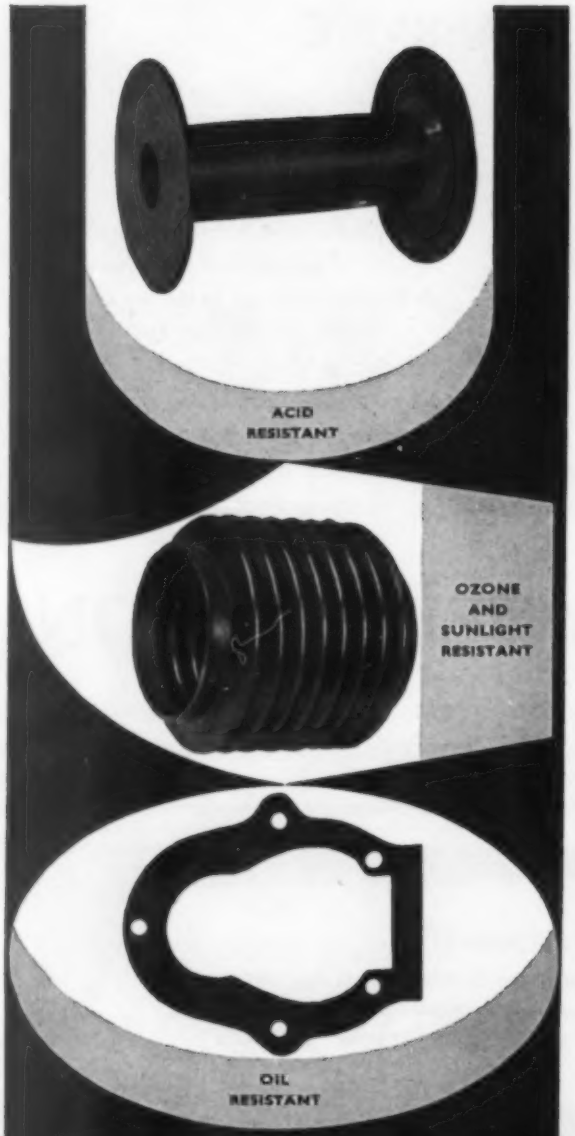

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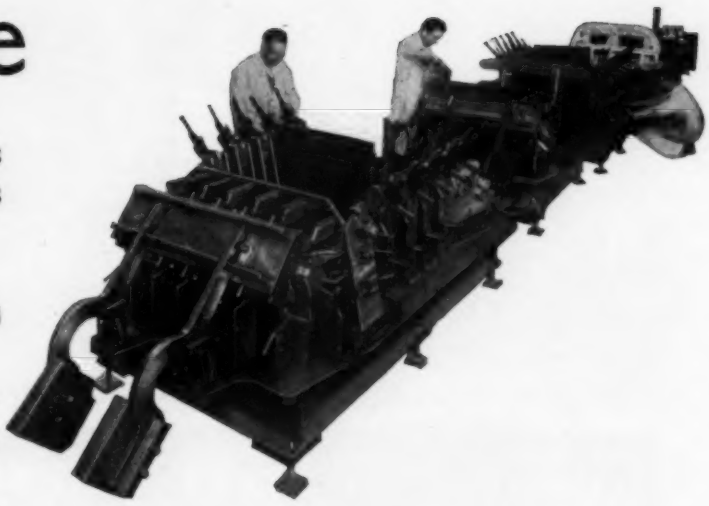

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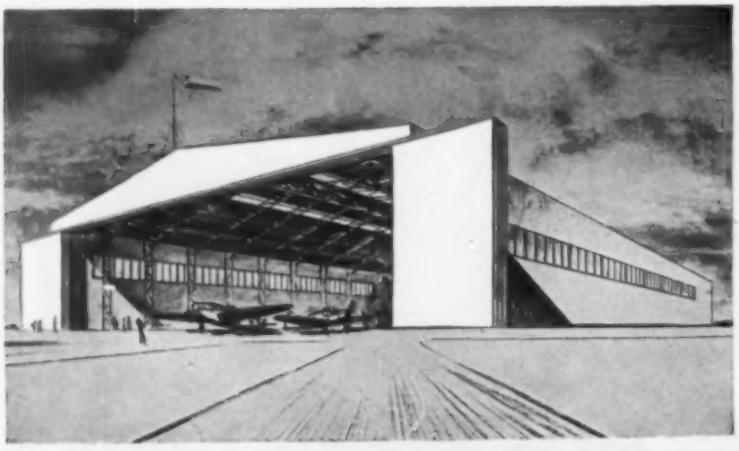

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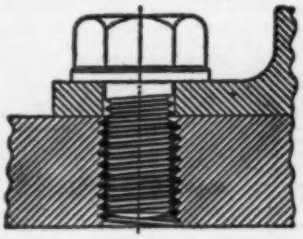

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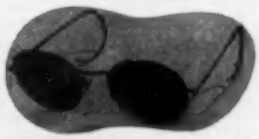

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Reply to Dept. C.P.S., 336/7, Strand, W.C.2, quoting Ref. 817.

AERODYNAMICISTS

FLUTTER TECHNICIANS

STRESSMEN

SENIOR AND INTERMEDIATE DRAUGHTSMEN

are urgently required for an extensive and super priority Guided Missile programme.

Applications will be treated in strictest confidence, and should be addressed to the

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AIR SERVICE TRAINING, LTD.,
HAMBLE, SOUTHAMPTON, HANTS.

SITUATIONS VACANT

Atomic Energy Research Establishment

HARWELL

has vacancies for

ENGINEERS

(i) Ref: 591/203. In the Instrumentation and Control Group of the Reactor Division, for work associated mainly with the engineering of specific reactor projects and including instrument development and the study and analysis of control schemes.

This post will be graded as either Engineer II or Engineer III.

(ii) Ref: 594/203. In the Electronics Division, to assist in the progressing and planning of the production of electronic equipment, both that made within the Establishment and that produced by industry. The duties will involve:

(a) Liaison between design staff at A.E.R.E. and contractors.
(b) Progressing components.
(c) Assessing contractor's production and development capabilities.
(d) Writing minutes of technical discussions and progress meetings.

This post will be graded as Engineer II.

APPLICANTS for both posts should have served a recognised engineering apprenticeship and be corporate members of a senior professional institution, for (ii) preferably the Institute of Mechanical Engineers, or have exempting qualifications.

FOR post (i) experience in one or more of the following fields is desirable: process control instrumentation, servomechanisms, electronics, nucleonic instrumentation, and telephone relay practice. A knowledge of contract and procurement procedure may be an advantage.

APPLICANTS for post (ii) should have had experience in the electronics or radio fields.

SALARY: Engineer II: £1,235-£1,655, according to qualifications and experience. Engineer III: £775 (at age 25)-£1,210. (Highest starting salary: £1,060.)

CONTRIBUTORY superannuation scheme; five-day week; excellent working conditions and generous leave allowances.

MARRIED officers living outside the establishment's transport area will be eligible for housing under authority arrangements, or, alternatively, substantial assistance towards legal expenses incurred in house purchase will be available.

SEND post card for application form, which must be returned by August 10, 1956, to Establishment Officer, A.E.R.E., Harwell, Didcot, Berks, quoting appropriate reference. [5529

THE COLLEGE OF AERONAUTICS

Applications are invited for the post of

LECTURER IN STRUCTURAL AND MECHANICAL TESTING in the DEPARTMENT OF AIRCRAFT DESIGN

CANDIDATES must have good engineering qualifications and experience in structural and mechanical testing. Experience in specialised fields of testing, e.g. hydraulics, vibration or elevated temperature work desirable.

DUTIES will include the conduct of laboratory classes and supervision of student and other research projects. Salary within the range of £850 to £1,200 p.a. with F.S.S.U. and Family Allowance. The appointment in the first place will be for three years' duration.

APPLICATIONS giving full particulars of qualifications and experience, and quoting names of three referees, to the Recorder, The College of Aeronautics, Cranfield, Bletchley, Bucks. Further particulars available. [5538

SAUNDERS-ROE, LIMITED

are to commence a further short course of

INSTRUCTION IN DRAUGHTSMANSHIP

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The object of the course is to prepare

SUITABLY EXPERIENCED MEN

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An engineering apprenticeship and the possession of an Ordinary National Certificate will be advantageous.

Those selected will receive reasonable salaries and enjoy full staff privileges during the training period.

Applications, giving full details of age, previous experience, salary, etc., and quoting reference P93 should be addressed to the Personnel Officer, Saunders-Roe, Limited, East Cowes, I.O.W. [5544

DRAUGHTSWOMEN required by Aircraft Equipment Company in South Bucks. Salary according to age and experience, up to £13 per week. Apply to Box No. 1775. [0475

AERODYNAMICIST

LOUIS NEWMARK, LTD. require an Aerodynamicist in their Laboratories at New Addington to take an active part in all stages of the development and flight trial work of auto-controls. A degree or similar qualification and some electrical knowledge is necessary, but previous industrial experience is not essential. Pension Scheme, etc. Apply in writing, giving full particulars to: Personnel Officer, Louis Newmark, Ltd., Prefect Works, Purley Way, Croydon, Surrey. [5553

BRITISH EUROPEAN AIRWAYS require Engineering Instructors (Electrical, Instrument and Engines) at London Airport to instruct Pilots and Engineers. Essential qualifications: apprenticeship in engineering; 5 years' practical experience in the maintenance of modern aircraft; technical knowledge to 'X' and 'C' Licence standard. City and Guilds' Certificate or Higher National Certificate an advantage. Salary £782 10s. 0d.-£1,120 per annum, depending upon experience and qualifications. Applications giving age, qualifications, and experience to Senior Personnel Officer (E. & S.), Flight Operations Department, B.E.A., Keyline House, Ruislip, Middlesex. [5536

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and

DRAUGHTSMEN

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at
CHADDERTON AND AT WOODFORD AERODROME

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require an

INSPECTOR

of advanced status and considerable experience of aircraft inspection work. Experience with light alloy welded components is essential. Candidates must have administrative ability and be able to organise as well as conduct inspection of prototype and development projects. Salary for this staff appointment will be commensurate with qualifications and experience. Contributory pension scheme. Written applications quoting Ref. SF2 and full details to **Personnel Officer (Staff), Magnesium Elektron Limited, Clifton, Junction, Swinton, near Manchester.**

SOUTH DEVON. Western Airways, Ltd., require the following staff for interesting work in their expanding design office at Exeter:—

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SENIOR Aircraft Electrical or Radio Draughtsman.

EXPERIENCED and reliable Drawing Checker.

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WRITE, stating age, experience and salary required to Design Office Superintendent, Western Airways, Ltd., Exeter Airport. [5549

WANTED. Works Manager. Preferably licensed. Electrical and ancillary overhaul workshops. Full details. House available. Surrey. Box 2113. [0976

WEST AFRICAN AIRWAYS CORPORATION require a Chief Accountant on direct contract at their Head Office in Lagos, Nigeria.

The candidate must meet the following requirements:—

(i) Age not less than 30 years;
(ii) Must have practical knowledge of budgetary control and standard costing and mechanised accounting;
(iii) Must hold a recognised professional accounting qualification;
(iv) Must have proven practical experience in a supervisory capacity.

PREVIOUS experience in the air transport industry will be of advantage but is not essential.

SALARY according to qualifications and experience. Free fully furnished quarters are provided and there are various allowances including expatriation pay.

ALL applications, marked "CA," should be forwarded to reach the Administrative Assistant, West African Airways Corporation, P.O. Box 136, Lagos, Nigeria, not later than August 6, 1956. [5502

STOREMAN required by helicopter operating company at Croydon. Apply Autair Ltd., 75 Wigmore Street, London, W.1. [5511

AIR Traffic Control Officer required at Contractors Airfield (operating single engine and military aircraft), South East England. R.A.F. or M.C.A. certificate required. Replies to Box 3085. [5520

TEST and Laboratory Engineers required for gyro and electro mechanical instruments. Apply stating age, experience and salary required to S. G. Brown, Ltd., Shakespeare Street, Watford, Herts. [0147

NAVIGATION Instructor. Ground Instructor required by Air Service Training, Ltd., Hamble, Southampton. For conditions of appointment apply to the Commandant, giving details and experience. [5533

AMERICAN Company in Calcutta require pilot with flying boat or seaplane experience and some mechanical knowledge for work in India and Parkistan. Reply quoting relevant qualifications to Box No. 2756. [5450

SENIOR Draughtsmen, particularly those with experience of the design of modern aircraft fuel systems and hydraulics are invited to apply for interesting positions now available at the Isle of Wight design offices of Saunders-Roe Limited.

ASSISTANCE with accommodation will be given to successful applicants.

PLEASE write, stating age, experience, salary, etc., quoting ref. F94 to the Personnel Officer, Saunders-Roe Limited, East Cowes, Isle of Wight. [5546

ENGINE/AIRFRAME Mechanic required by Trans-Canada Air Lines. Applications to be made in writing to Assistant Regional Maintenance Superintendent, London Airport, Hounslow, Middx., or phone SKYPORT 2331, ext. 50. [5521

ENGINEER (Aircraft) required by Tanganyika Government, Lands and Surveys Department. Salary scale (including inducement pay and present 10% temporary allowance) £1,003 rising to £1,280 a year. Appointment either (i) on probation for two years to permanent and pensionable establishment or (ii) on contract for one tour of 30-36 months with gratuity at rate of 13½% of total basic salary and inducement pay drawn. Outfit allowance £15 and free uniform with upkeep allowance of £20 a year. Free passages. Liberal leave on full salary. Candidates must possess aircraft maintenance engineer's licences in categories "A" and "C" preferably on modern twin- or four-engined aircraft of metal construction. Write to the Crown Agents, 4, Millbank, London, S.W.1. State age, name in block letters, full qualifications and experience and quote M2A/41766/FE. [5547

BRITISH WEST INDIAN AIRWAYS, LTD., Trinidad, urgently require shift engineers and inspectors. Applicants should possess A.M.E. licence in categories A. and C. with two endorsements in each category covering airframe and engines of Dakota, Viking or Viscount aircraft. Applications would be considered from holders of A. and C. licences with at least two endorsements applicable to the above aircraft and engines provided the other two endorsements are for aircraft or engine types similar to, or larger than, those mentioned above. Commencing salary BWI $425 per month, rising to BWI $450 per month plus cost of living allowance of BWI $47.28 p.m. (equal to £1,180-£1,243 p.a.) plus an expatriation allowance of BWI $80 per month. Accommodation available at cost of BWI $90 p.m. Leave, two weeks per annum locally and three months in U.K. at end of each period of three years. Immediate applications to Personnel Officer (Associated Companies), B.O.A.C. Headquarters, P.406, London Airport, Feltham, Middlesex. [5509

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Full details of qualifications and experience to Personnel Manager, Folland Aircraft, Ltd., Hamble, Hants. [5555

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CHIEF Inspector required for small Aircraft Works in South of England. Excellent opportunity in newly formed section for keen, experienced man. Apply, giving full details of past experience to Box No. 3087. [5522

HELICOPTER ENGINEER REQUIRED with Sikorsky S.51 Licence. Must be prepared to serve initial period approximately 6 months abroad. Liberal overseas allowance. Full particulars to: Autair Ltd., 75 Wigmore Street, London, W.1. [5510

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WANTED immediately, Senior and Intermediate Draughtsmen for work on an interesting Aircraft programme. Good salaries and conditions. Apply in writing with details of previous experience to: King Aircraft Corporation, Hillington, Glasgow, S.W.2. [0423

SCOTTISH AVIATION LIMITED require an Assistant Purchasing Officer. Applicants should be aged 30-35 years, and have full purchasing experience preferably in Aircraft Markets and able to accept responsibility. Applications to be made to Personnel Manager, Scottish Aviation Limited, Prestwick Airport, Ayrshire. [5481

AIRCRAFT Draughtsmen experienced in the design of (a) structures (b) fuel and/or hydraulic systems required for interesting and permanent positions on the South Coast. Salaries are high, pension scheme available, excellent conditions. Please apply quoting reference AIR and giving full particulars of qualifications and experience to Box No. 3239. [5548

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A DOMINION Government department requires the services in the United Kingdom of an Aeronautical Engineer having experience in the administration and control of Airframe repair and overhaul contracts. Suggested salary £1,500 p.a. Please send particulars of age, qualifications, experience, etc. to Box No. 3258. [5554

A LARGE aircraft company situated South West England has a vacancy for an Assistant Contracts Manager. A man 30-40 years of age required. Previous contracts experience essential, a technical background and/or a university education desirable. Applications stating age, full details of education and previous experience, should be addressed to Box No. 3125. [5528

A VACANCY exists for a certificated Air Traffic Control Officer, Grade III, at the States of Jersey Airport. Candidates must have Approach and Aerodrome Control ratings. A Traffic Director/Radar/rating will be an advantage. Applicants must be between the ages of 23 and 35. Salary, on entry, ranges from £580 (age 23) to £740 (age 30 or over) rising by annual increments to £950.

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APPLICATIONS should be sent to the Greffier of the States, States' Greffe, Jersey, giving date of birth, full details of experience and names and addresses of two referees, so as to arrive not later than 11th August, 1956. [5532

APPLICATIONS are invited from Radio Engineers, preferably licensed, who would be interested in employment with British whaling company to work on Westland S.55 helicopters attached to Antarctic floating factory expeditions which depart each year October, returning April/May. Attractive terms include good salary and two months holiday each summer. Preference given to applicants with experience of aircraft instruments and electrical systems. Applications with full particulars to Chr. Salvesen & Co., 29 Bernard Street, Leith. [5534

MARSHALL

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SALES Engineer for leading manufacturers of Fuel and Lubricating Oil Filters. Applications invited from well educated men with sound engineering training. Desirable qualifications are: good knowledge of internal combustion and compression ignition engines, filtration problems and ability to handle sales correspondence. Give full particulars in chronological order together with age and salary required to Box No. 3043. [5512

COMMERCIAL Manager. Applications are invited for the position of Commercial Manager, responsible to the Managing Director for the purchase, sale, control of all materials—negotiating sales and buying contracts, sub-contract overhauls. Sound technical background and knowledge of the aircraft market essential. Salary according to qualifications. Apply in confidence to Managing Director, Eagle Aircraft Services, Ltd., Blackbushe Airport, Camberley, Surrey, Yateley 2371. [5508

MANUFACTURERS of gas turbine engines have vacancies for Mechanical Engineering Draughtsmen interested in Installation Design. Ordinary National Certificate or Higher National Certificate in Mechanical Engineering an advantage although not essential. Age limits 19 to 28. Positions hold good prospects for young men willing to learn and work hard, with commensurate salaries and pension scheme. Apply to Reference Installation/2, Box No. 8528. [0462

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THE man Bristol need would be of at least H.N.C. standard and have his ground engineer's licence (Category 'X'—electrical equipment and/or instruments).

IF you think you can do the job, write with full details of age, experience, qualifications, etc. to: Mr. P. A. Tobin, Room FDO/69/JF, Bristol Aircraft Limited, Filton House, Bristol. [5541

ASSISTANT Office Manager required for Commercial Sales Department in N.W. London Area, in leading firm of Aircraft Instrument Manufacturers. Age 28/35 with thorough knowledge of general office routine and correspondence. Capable of controlling and administering a small staff. Salary within the range of £700/£775, excellent medium and long term prospects. Pension Scheme. Applications with full details to Box 2 G M8111 A.K. Advtg., 212a, Shaftesbury Ave, London, W.C.2. [5542

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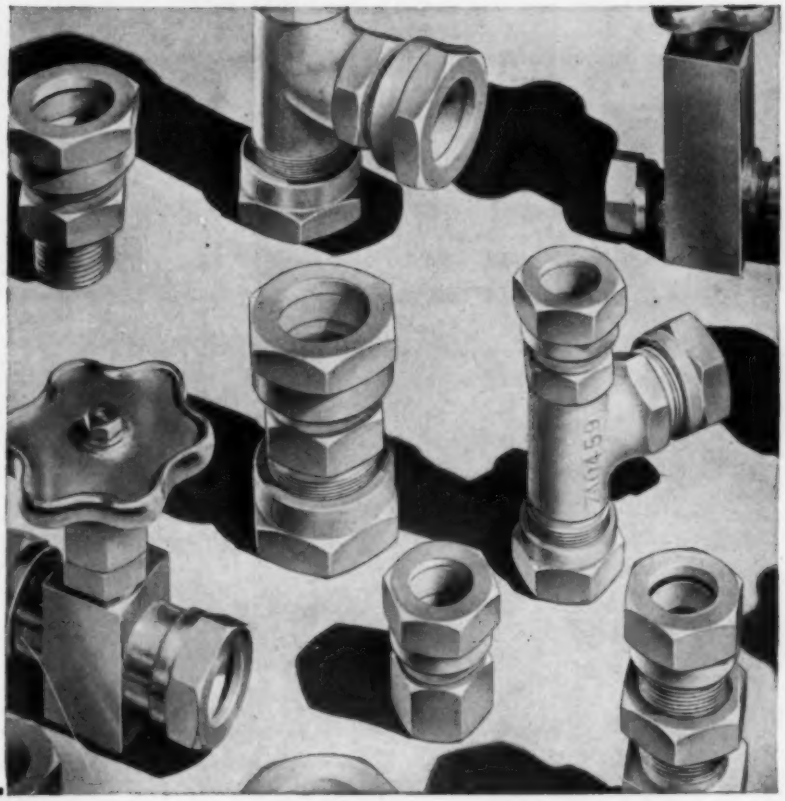

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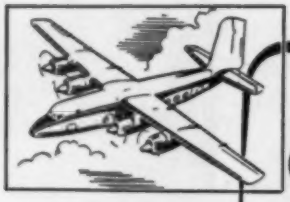

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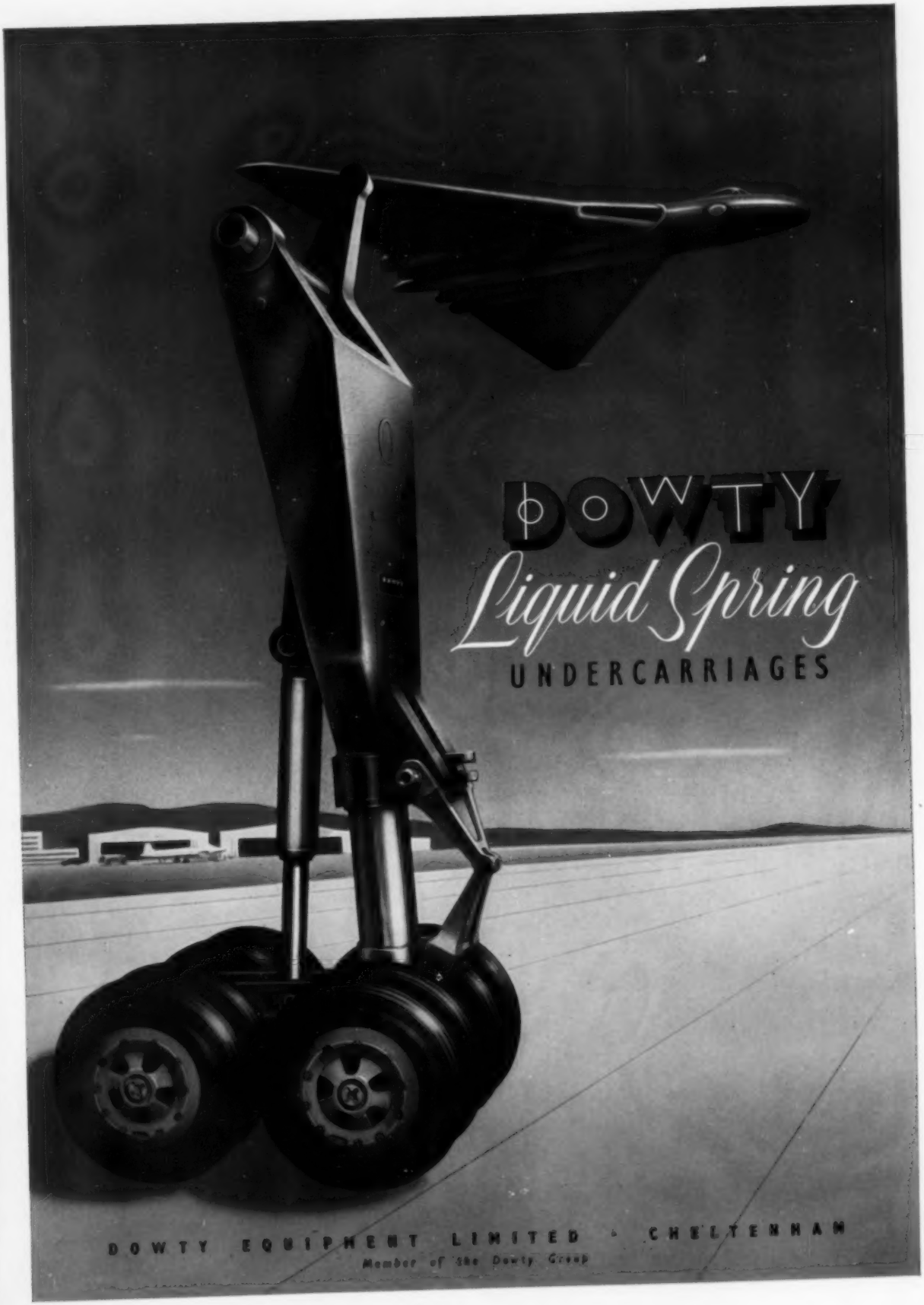
Printed in Great Britain for the Publishers, ILIFFE & SONS LTD., Dorset House, Stamford Street, London, S.E.1, by SUN PRINTERS LTD., London, and Watford, Herts. Flight can be obtained abroad from the following: AUSTRALIA AND NEW ZEALAND: Gordon & Gotch, Ltd. INDIA: A. H. Wheeler & Co. CANADA: The Wm. Dawson Subscription Service, Ltd.; Gordon & Gotch, Ltd. SOUTH AFRICA: Central News Agency, Ltd.; Wm. Dawson & Sons (S.A.), Ltd. UNITED STATES: The International News Co. Entered as Second Class Matter at the New York, U.S.A., Post Office.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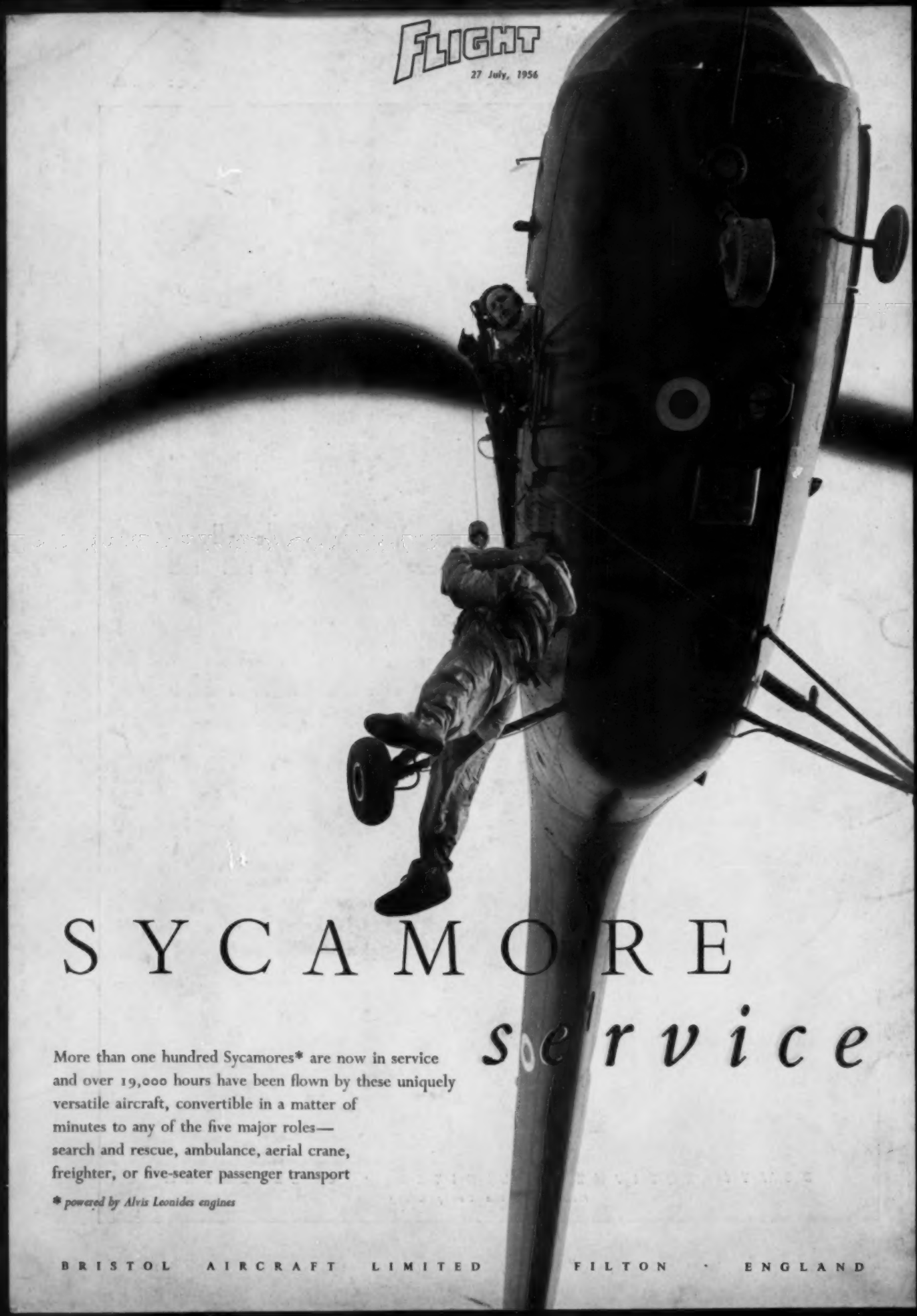

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